

SEQUENCE LISTING

<110> Chappell, Joseph
Noel, Joseph P.
Starks, Courtney M.
Manna, Kathleen R.

<120> SYNTHASES

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Ser Ile Asp Asn Gln Val Ala Glu Lys Tyr Ala Gln Glu Ile Glu Ala	
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Leu Lys Glu Gln Thr Arg Ser Met Leu Leu Ala Thr Gly Arg Lys Leu	
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gcc Ala 65	gat Asp	aca Thr	ttg Leu	aat Asn	ttg Leu 70	att Ile	gac Asp	att Ile	att Ile	gaa Glu 75	cgc Arg	ctt Leu	ggg Gly	ata Ile	tcc Ser 80	240
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 Val Ala Asp Phe Ser Pro Ser Leu Trp Gly Asp Gln Phe Leu Ser Phe
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 tcc att gat aat cag gtt gcg gaa aag tat gct caa gag att gaa gca 144
 Ser Ile Asp Asn Gln Val Ala Glu Lys Tyr Ala Gln Glu Ile Glu Ala
 35 40 45
 ttg aag gaa caa acg agg agt atg ctg tta gca acc gga agg aaa ttg 192
 Leu Lys Glu Gln Thr Arg Ser Met Leu Leu Ala Thr Gly Arg Lys Leu
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 gcc gat aca ttg aat ttg att gac att att gaa cgc ctt ggt ata tcc 240
 Ala Asp Thr Leu Asn Leu Ile Asp Ile Ile Glu Arg Leu Gly Ile Ser
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 tac cac ttt gag aaa gaa att gat gag att ttg gat cag att tac aac 288
 Tyr His Phe Glu Lys Glu Ile Asp Glu Ile Leu Asp Gln Ile Tyr Asn
 85 90 95
 caa aac tca aac tgc aat gat ttg tgc acc tct gca ctt caa ttt cga 336
 Gln Asn Ser Asn Cys Asn Asp Leu Cys Thr Ser Ala Leu Gln Phe Arg
 100 105 110
 ttg ctc agg caa cac ggt ttc aac atc tct cct gaa att ttc agc aaa 384
 Leu Leu Arg Gln His Gly Phe Asn Ile Ser Pro Glu Ile Phe Ser Lys
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 Phe Gln Asp Glu Asn Gly Lys Phe Lys Glu Ser Leu Ala Ser Asp Val
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Ser	Ala	Ala	Pro	His	Leu	Lys	Ser	Pro	Leu	Arg	Glu	Gln	Val	Thr	His	
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Met	Leu	Val	Lys	Thr	Ile	Ser	Met	Ile	Ser	Ile	Val	Asp	Asp	Thr	Phe	
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gaa Glu	gga Gly	tat Tyr	atg Met	cca Pro	cct Pro	gtt Val	tct Ser	gaa Glu	tac Tyr	cta Leu	agc Ser	aat Asn	gca Ala	cta Leu	gca Ala	1200
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	450					455					460					
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			485						490					495		
agg Arg	ccc Pro	act Thr	ccc Pro	gtc Val	tct Ser	aca Thr	gaa Glu	ttt Phe	tta Leu	act Thr	cct Pro	att Ile	ctc Leu	aat Asn	ctt Leu	1536
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Ala	Leu	Glu	Gln	Cys	Leu	His	Lys	Gly	Val	Pro	Arg	Val	Glu	Thr	Arg			
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Phe	Phe	Ile	Ser	Ser	Ile	Tyr	Asp	Lys	Glu	Gln	Ser	Lys	Asn	Asn	Val			
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Lys	Gln	Glu	Leu	Ala	Gln	Val	Ser	Arg	Trp	Trp	Lys	Asp	Leu	Asp	Phe			
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Val	Ala	Asp	Phe	Ser	Pro	Ser	Leu	Trp	Gly	Asp	Gln	Phe	Leu	Ser	Phe	
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Ala	Asp	Thr	Leu	Asn	Leu	Ile	Asp	Ile	Ile	Glu	Arg	Leu	Gly	Ile	Ser	
	65				70					75					80	
tac	cac	ttt	gag	aaa	gaa	att	gat	gag	att	ttg	gat	cag	att	tac	aac	288
Tyr	His	Phe	Glu	Lys	Glu	Ile	Asp	Glu	Ile	Leu	Asp	Gln	Ile	Tyr	Asn	

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Gln	Asn	Ser	Asn	Cys	Asn	Asp	Leu	Cys	Thr	Ser	Ala	Leu	Gln	Phe	Arg		
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Leu	Leu	Arg	Gln	His	Gly	Phe	Asn	Ile	Ser	Pro	Glu	Ile	Phe	Ser	Lys		
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Phe	Gln	Asp	Glu	Asn	Gly	Lys	Phe	Lys	Glu	Ser	Leu	Ala	Ser	Asp	Val		
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Ser	Ala	Ala	Pro	His	Leu	Lys	Ser	Pro	Leu	Arg	Glu	Gln	Val	Thr	His		
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Ala	Leu	Glu	Gln	Cys	Leu	His	Lys	Gly	Val	Pro	Arg	Val	Glu	Thr	Arg		
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Phe	Phe	Ile	Ser	Ser	Ile	Tyr	Asp	Lys	Glu	Gln	Ser	Lys	Asn	Asn	Val		
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Val	Thr	Thr	Leu	Pro	Tyr	Ala	Arg	Asp	Arg	Val	Val	Glu	Cys	Tyr	Phe		
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Cys	Met	Arg	Asp	Tyr	Gly	Ile	Ser	Thr	Lys	Glu	Ala	Met	Ala	Lys	Phe
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Gln	Asn	Met	Ala	Glu	Thr	Ala	Trp	Lys	Asp	Ile	Asn	Glu	Gly	Leu	Leu
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96

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Thr	Thr	Thr	Tyr	Tyr	Tyr	Leu	Ala	Thr	Thr	Ser	Tyr	Leu	Gly	Met	Lys
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Ser	Ala	Thr	Glu	Gln	Asp	Phe	Glu	Trp	Leu	Ser	Lys	Asn	Pro	Lys	Ile
			420					425					430		
Leu	Glu	Ala	Ser	Val	Ile	Ile	Trp	Arg	Val	Ile	Asp	Asp	Thr	Ala	Thr
		435					440					445			
Tyr	Glu	Val	Glu	Lys	Ser	Arg	Gly	Gln	Ile	Ala	Thr	Gly	Ile	Glu	Cys
	450					455					460				
Cys	Met	Arg	Asp	Tyr	Gly	Ile	Ser	Thr	Lys	Glu	Ala	Met	Ala	Lys	Phe
465					470					475					480
Gln	Asn	Met	Ala	Glu	Thr	Ala	Trp	Lys	Asp	Ile	Asn	Glu	Gly	Leu	Leu
				485					490					495	
Arg	Pro	Thr	Pro	Val	Ser	Thr	Glu	Phe	Leu	Thr	Pro	Ile	Leu	Asn	Leu
			500					505					510		
Ala	Arg	Ile	Val	Glu	Val	Thr	Tyr	Ile	His	Asn	Leu	Asp	Gly	Tyr	Thr
		515					520					525			
His	Pro	Glu	Lys	Val	Leu	Lys	Pro	His	Ile	Ile	Asn	Leu	Leu	Val	Asp
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Ser	Ile	Lys	Ile												
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 <211> 1644
 <212> DNA
 <213> TEAS 406/407

<220>
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<400> 11

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gtc gcc gac ttc tcc cct agt ctc tgg ggt gat cag ttc ctt tca ttc	96
Val Ala Asp Phe Ser Pro Ser Leu Trp Gly Asp Gln Phe Leu Ser Phe	
20 25 30	
tcc att gat aat cag gtt gcg gaa aag tat gct caa gag att gaa gca	144
Ser Ile Asp Asn Gln Val Ala Glu Lys Tyr Ala Gln Glu Ile Glu Ala	
35 40 45	
ttg aag gaa caa acg agg agt atg ctg tta gca acc gga agg aaa ttg	192
Leu Lys Glu Gln Thr Arg Ser Met Leu Leu Ala Thr Gly Arg Lys Leu	
50 55 60	
gcc gat aca ttg aat ttg att gac att att gaa cgc ctt ggt ata tcc	240
Ala Asp Thr Leu Asn Leu Ile Asp Ile Ile Glu Arg Leu Gly Ile Ser	
65 70 75 80	
tac cac ttt gag aaa gaa att gat gag att ttg gat cag att tac aac	288
Tyr His Phe Glu Lys Glu Ile Asp Glu Ile Leu Asp Gln Ile Tyr Asn	
85 90 95	
caa aac tca aac tgc aat gat ttg tgc acc tct gca ctt caa ttt cga	336
Gln Asn Ser Asn Cys Asn Asp Leu Cys Thr Ser Ala Leu Gln Phe Arg	
100 105 110	
ttg ctc agg caa cac ggt ttc aac atc tct cct gaa att ttc agc aaa	384
Leu Leu Arg Gln His Gly Phe Asn Ile Ser Pro Glu Ile Phe Ser Lys	
115 120 125	
ttc caa gat gaa aat ggc aaa ttc aag gag tct ctt gct agt gat gtc	432
Phe Gln Asp Glu Asn Gly Lys Phe Lys Glu Ser Leu Ala Ser Asp Val	
130 135 140	
tta gga tta tta aac ttg tat gaa gct tca cat gta agg act cat gct	480
Leu Gly Leu Leu Asn Leu Tyr Glu Ala Ser His Val Arg Thr His Ala	
145 150 155 160	
gac gat atc tta gaa gac gca ctt gct ttc tcc act atc cat ctt gaa	528
Asp Asp Ile Leu Glu Asp Ala Leu Ala Phe Ser Thr Ile His Leu Glu	
165 170 175	

tct gca gct cca cat ttg aaa tct cca ctt agg gag caa gtg aca cat	576
Ser Ala Ala Pro His Leu Lys Ser Pro Leu Arg Glu Gln Val Thr His	
180 185 190	
gcc ctt gag caa tgt ttg cac aag ggt gtt cct aga gtc gag acc cga	624
Ala Leu Glu Gln Cys Leu His Lys Gly Val Pro Arg Val Glu Thr Arg	
195 200 205	
ttc ttc atc tca tca atc tat gac aag gaa caa tcg aag aat aat gtg	672
Phe Phe Ile Ser Ser Ile Tyr Asp Lys Glu Gln Ser Lys Asn Asn Val	
210 215 220	
tta ctt cga ttt gcc aaa ttg gat ttc aac ttg ctc gag atg ttg cac	720
Leu Leu Arg Phe Ala Lys Leu Asp Phe Asn Leu Leu Gln Met Leu His	
225 230 235 240	
aaa caa gaa ctt gct caa gta tca agg tgg tgg aaa gat ttg gat ttt	768
Lys Gln Glu Leu Ala Gln Val Ser Arg Trp Trp Lys Asp Leu Asp Phe	
245 250 255	
gta aca aca ctt cca tat gct aga gat cga gta gtt gaa tgc tac ttt	816
Val Thr Thr Leu Pro Tyr Ala Arg Asp Arg Val Val Glu Cys Tyr Phe	
260 265 270	
tgg gca tta gga gtt tat ttt gag cct caa tac tct caa gct cgc gtc	864
Trp Ala Leu Gly Val Tyr Phe Glu Pro Gln Tyr Ser Gln Ala Arg Val	
275 280 285	
atg ctc gtt aag acc ata tca atg att tcg att gtc gat gac acc ttt	912
Met Leu Val Lys Thr Ile Ser Met Ile Ser Ile Val Asp Asp Thr Phe	
290 295 300	
gat gct tac ggt aca gtt aaa gaa ctt gag gca tac aca gat gcc ata	960
Asp Ala Tyr Gly Thr Val Lys Glu Leu Glu Ala Tyr Thr Asp Ala Ile	
305 310 315 320	
caa aga tgg gat atc aac gaa att gat cgg ctt cct gat tac atg aaa	1008
Gln Arg Trp Asp Ile Asn Glu Ile Asp Arg Leu Pro Asp Tyr Met Lys	
325 330 335	
atc agt tat aaa gct att cta gat ctc tac aag gat tat gaa aag gaa	1056
Ile Ser Tyr Lys Ala Ile Leu Asp Leu Tyr Lys Asp Tyr Glu Lys Glu	
340 345 350	
ttg tct agt gcc gga aga tct cat att gtc tgc cat gca ata gaa aga	1104
Leu Ser Ser Ala Gly Arg Ser His Ile Val Cys His Ala Ile Glu Arg	
355 360 365	
atg aaa gaa gta gta aga aat tat aat gtc gag tca aca tgg ttt att	1152
Met Lys Glu Val Val Arg Asn Tyr Asn Val Glu Ser Thr Trp Phe Ile	
370 375 380	

gaa gga tat atg cca cct gtt tct gaa tac cta agc aat gca cta gca	1200
Glu Gly Tyr Met- Pro Pro Val Ser Glu Tyr Leu Ser Asn Ala Leu Ala	
385 390 395 400	
act acc aca tat tac nns nns gcg aca aca tcg tat ttg ggc atg aag	1248
Thr Thr Thr Tyr Tyr Xaa Xaa Ala Thr Thr Ser Tyr Leu Gly Met Lys	
405 410 415	
tct gcc acg gag caa gat ttt gag tgg ttg tca aag aat cca aaa att	1296
Ser Ala Thr Glu Gln Asp Phe Glu Trp Leu Ser Lys Asn Pro Lys Ile	
420 425 430	
ctt gaa gct agt gta att ata tgt cga gtt atc gat gac aca gcc acg	1344
Leu Glu Ala Ser Val Ile Ile Cys Arg Val Ile Asp Asp Thr Ala Thr	
435 440 445	
tac gag gtt gag aaa agc agg gga caa att gca act gga att gag tgc	1392
Tyr Glu Val Glu Lys Ser Arg Gly Gln Ile Ala Thr Gly Ile Glu Cys	
450 455 460	
tgc atg aga gat tat ggt ata tca aca aaa gag gca atg gct aaa ttt	1440
Cys Met Arg Asp Tyr Gly Ile Ser Thr Lys Glu Ala Met Ala Lys Phe	
465 470 475 480	
caa aat atg gct gag aca gca tgg aaa gat att aat gaa gga ctt ctt	1488
Gln Asn Met Ala Glu Thr Ala Trp Lys Asp Ile Asn Glu Gly Leu Leu	
485 490 495	
agg ccc act ccc gtc tct aca gaa ttt tta act cct att ctc aat ctt	1536
Arg Pro Thr Pro Val Ser Thr Glu Phe Leu Thr Pro Ile Leu Asn Leu	
500 505 510	
gct cgt att gtt gag gtt aca tat ata cac aat cta gat gga tac act	1584
Ala Arg Ile Val Glu Val Thr Tyr Ile His Asn Leu Asp Gly Tyr Thr	
515 520 525	
cat ccg gag aaa gtc tta aaa cct cac att att aac cta ctt gtg gac	1632
His Pro Glu Lys Val Leu Lys Pro His Ile Ile Asn Leu Leu Val Asp	
530 535 540	
tcc atc aaa att	1644
Ser Ile Lys Ile	
545	

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 <212> PRT
 <213> TEAS 406/407

<400> 12
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			20					25					30		
Ser	Ile	Asp	Asn	Gln	Val	Ala	Glu	Lys	Tyr	Ala	Gln	Glu	Ile	Glu	Ala
		35					40					45			
Leu	Lys	Glu	Gln	Thr	Arg	Ser	Met	Leu	Leu	Ala	Thr	Gly	Arg	Lys	Leu
	50					55					60				
Ala	Asp	Thr	Leu	Asn	Leu	Ile	Asp	Ile	Ile	Glu	Arg	Leu	Gly	Ile	Ser
65				70						75					80
Tyr	His	Phe	Glu	Lys	Glu	Ile	Asp	Glu	Ile	Leu	Asp	Gln	Ile	Tyr	Asn
				85				90						95	
Gln	Asn	Ser	Asn	Cys	Asn	Asp	Leu	Cys	Thr	Ser	Ala	Leu	Gln	Phe	Arg
			100					105					110		
Leu	Leu	Arg	Gln	His	Gly	Phe	Asn	Ile	Ser	Pro	Glu	Ile	Phe	Ser	Lys
		115					120					125			
Phe	Gln	Asp	Glu	Asn	Gly	Lys	Phe	Lys	Glu	Ser	Leu	Ala	Ser	Asp	Val
	130					135					140				
Leu	Gly	Leu	Leu	Asn	Leu	Tyr	Glu	Ala	Ser	His	Val	Arg	Thr	His	Ala
145				150						155					160
Asp	Asp	Ile	Leu	Glu	Asp	Ala	Leu	Ala	Phe	Ser	Thr	Ile	His	Leu	Glu
				165					170					175	
Ser	Ala	Ala	Pro	His	Leu	Lys	Ser	Pro	Leu	Arg	Glu	Gln	Val	Thr	His
			180					185					190		
Ala	Leu	Glu	Gln	Cys	Leu	His	Lys	Gly	Val	Pro	Arg	Val	Glu	Thr	Arg
		195					200					205			
Phe	Phe	Ile	Ser	Ser	Ile	Tyr	Asp	Lys	Glu	Gln	Ser	Lys	Asn	Asn	Val
	210					215					220				
Leu	Leu	Arg	Phe	Ala	Lys	Leu	Asp	Phe	Asn	Leu	Leu	Gln	Met	Leu	His
225					230					235					240
Lys	Gln	Glu	Leu	Ala	Gln	Val	Ser	Arg	Trp	Trp	Lys	Asp	Leu	Asp	Phe
				245					250					255	
Val	Thr	Thr	Leu	Pro	Tyr	Ala	Arg	Asp	Arg	Val	Val	Glu	Cys	Tyr	Phe
			260					265					270		
Trp	Ala	Leu	Gly	Val	Tyr	Phe	Glu	Pro	Gln	Tyr	Ser	Gln	Ala	Arg	Val
		275					280					285			
Met	Leu	Val	Lys	Thr	Ile	Ser	Met	Ile	Ser	Ile	Val	Asp	Asp	Thr	Phe
	290				295						300				
Asp	Ala	Tyr	Gly	Thr	Val	Lys	Glu	Leu	Glu	Ala	Tyr	Thr	Asp	Ala	Ile
305				310						315					320
Gln	Arg	Trp	Asp	Ile	Asn	Glu	Ile	Asp	Arg	Leu	Pro	Asp	Tyr	Met	Lys
				325					330					335	
Ile	Ser	Tyr	Lys	Ala	Ile	Leu	Asp	Leu	Tyr	Lys	Asp	Tyr	Glu	Lys	Glu
			340					345					350		
Leu	Ser	Ser	Ala	Gly	Arg	Ser	His	Ile	Val	Cys	His	Ala	Ile	Glu	Arg
		355					360					365			
Met	Lys	Glu	Val	Val	Arg	Asn	Tyr	Asn	Val	Glu	Ser	Thr	Trp	Phe	Ile
	370					375					380				
Glu	Gly	Tyr	Met	Pro	Pro	Val	Ser	Glu	Tyr	Leu	Ser	Asn	Ala	Leu	Ala
385				390						395					400
Thr	Thr	Thr	Tyr	Tyr	Xaa	Xaa	Ala	Thr	Thr	Ser	Tyr	Leu	Gly	Met	Lys
				405					410					415	
Ser	Ala	Thr	Glu	Gln	Asp	Phe	Glu	Trp	Leu	Ser	Lys	Asn	Pro	Lys	Ile
			420					425					430		
Leu	Glu	Ala	Ser	Val	Ile	Ile	Cys	Arg	Val	Ile	Asp	Asp	Thr	Ala	Thr

	435					440				445					
Tyr	Glu	Val	Glu	Lys	Ser	Arg	Gly	Gln	Ile	Ala	Thr	Gly	Ile	Glu	Cys
	450					455					460				
Cys	Met	Arg	Asp	Tyr	Gly	Ile	Ser	Thr	Lys	Glu	Ala	Met	Ala	Lys	Phe
465					470					475					480
Gln	Asn	Met	Ala	Glu	Thr	Ala	Trp	Lys	Asp	Ile	Asn	Glu	Gly	Leu	Leu
				485					490					495	
Arg	Pro	Thr	Pro	Val	Ser	Thr	Glu	Phe	Leu	Thr	Pro	Ile	Leu	Asn	Leu
			500					505					510		
Ala	Arg	Ile	Val	Glu	Val	Thr	Tyr	Ile	His	Asn	Leu	Asp	Gly	Tyr	Thr
		515					520					525			
His	Pro	Glu	Lys	Val	Leu	Lys	Pro	His	Ile	Ile	Asn	Leu	Leu	Val	Asp
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Ser	Ile	Lys	Ile												
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<220>
 <223> primer

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33

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<220>
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33

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<220>
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33

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<220>
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<400> 16
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33

<210> 17
 <211> 54
 <212> DNA
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 <223> primer

<400> 17
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54

<210> 18
 <211> 54
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> primer

<400> 18
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54

<210> 19
 <211> 2018
 <212> DNA
 <213> Abies grandis

<220>
 <221> CDS
 <222> (6)...(1892)
 <223> pinene synthase

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 Met Ala Leu Val Ser Thr Ala Pro Leu Ala Ser Lys Ser Cys Leu
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50

cac aaa tcg ttg atc agt tct acc cat gag ctt aag gct ctc tct aga
 His Lys Ser Leu Ile Ser Ser Thr His Glu Leu Lys Ala Leu Ser Arg
 20 25 30

98

aca	att	cca	gct	cta	gga	atg	agt	agg	cga	ggg	aaa	tct	atc	act	cct	146
Thr	Ile	Pro	Ala	Leu	Gly	Met	Ser	Arg	Arg	Gly	Lys	Ser	Ile	Thr	Pro	
			35					40					45			
tcc	atc	agc	atg	agc	tct	acc	acc	gtt	gta	acc	gat	gat	ggg	gta	cga	194
Ser	Ile	Ser	Met	Ser	Ser	Thr	Thr	Val	Val	Thr	Asp	Asp	Gly	Val	Arg	
		50					55					60				
aga	cgc	atg	ggc	gat	ttc	cat	tcc	aac	ctc	tgg	gac	gat	gat	gtc	ata	242
Arg	Arg	Met	Gly	Asp	Phe	His	Ser	Asn	Leu	Trp	Asp	Asp	Asp	Val	Ile	
	65					70					75					
cag	tct	tta	cca	acg	gct	tat	gag	gaa	aaa	tcg	tac	ctg	gag	cgt	gct	290
Gln	Ser	Leu	Pro	Thr	Ala	Tyr	Glu	Glu	Lys	Ser	Tyr	Leu	Glu	Arg	Ala	
80					85					90					95	
gag	aaa	ctg	atc	ggg	gaa	gta	aag	aac	atg	ttc	aat	tcg	atg	tca	tta	338
Glu	Lys	Leu	Ile	Gly	Glu	Val	Lys	Asn	Met	Phe	Asn	Ser	Met	Ser	Leu	
				100					105					110		
gaa	gat	gga	gag	tta	atg	agt	ccg	ctc	aat	gat	ctc	att	caa	cgc	ctt	386
Glu	Asp	Gly	Glu	Leu	Met	Ser	Pro	Leu	Asn	Asp	Leu	Ile	Gln	Arg	Leu	
			115					120					125			
tgg	att	gtc	gac	agc	ctt	gaa	cgt	ttg	ggg	atc	cat	aga	cat	ttc	aaa	434
Trp	Ile	Val	Asp	Ser	Leu	Glu	Arg	Leu	Gly	Ile	His	Arg	His	Phe	Lys	
		130					135					140				
gat	gag	ata	aaa	tcg	gcg	ctt	gat	tat	gtt	tac	agt	tat	tgg	ggc	gaa	482
Asp	Glu	Ile	Lys	Ser	Ala	Leu	Asp	Tyr	Val	Tyr	Ser	Tyr	Trp	Gly	Glu	
	145					150					155					
aat	ggc	atc	gga	tgc	ggg	agg	gag	agt	gtt	gtt	act	gat	ctg	aac	tca	530
Asn	Gly	Ile	Gly	Cys	Gly	Arg	Glu	Ser	Val	Val	Thr	Asp	Leu	Asn	Ser	
160					165					170					175	
act	gcg	ttg	ggg	ctt	cga	acc	cta	cga	cta	cac	gga	tac	ccg	gtg	tct	578
Thr	Ala	Leu	Gly	Leu	Arg	Thr	Leu	Arg	Leu	His	Gly	Tyr	Pro	Val	Ser	
				180					185					190		
tca	gat	gtt	ttc	aaa	gct	ttc	aaa	ggc	caa	aat	ggg	cag	ttt	tcc	tgc	626
Ser	Asp	Val	Phe	Lys	Ala	Phe	Lys	Gly	Gln	Asn	Gly	Gln	Phe	Ser	Cys	
			195					200					205			
tct	gaa	aat	att	cag	aca	gat	gaa	gag	atc	aga	ggc	gtt	ctg	aat	tta	674
Ser	Glu	Asn	Ile	Gln	Thr	Asp	Glu	Glu	Ile	Arg	Gly	Val	Leu	Asn	Leu	
		210					215					220				
ttc	cgg	gcc	tcc	ctc	att	gcc	ttt	cca	ggg	gag	aaa	att	atg	gat	gag	722
Phe	Arg	Ala	Ser	Leu	Ile	Ala	Phe	Pro	Gly	Glu	Lys	Ile	Met	Asp	Glu	
	225					230					235					

gct gaa atc ttc tct acc aaa tat tta aaa gaa gcc ctg caa aag att Ala Glu Ile Phe Ser Thr Lys Tyr Leu Lys Glu Ala Leu Gln Lys Ile 240 245 250 255	770
ccg gtc tcc agt ctt tcg cga gag atc ggg gac gtt ttg gaa tat ggt Pro Val Ser Ser Leu Ser Arg Glu Ile Gly Asp Val Leu Glu Tyr Gly 260 265 270	818
tgg cac aca tat ttg ccg cga ttg gaa gca agg aat tac atc caa gtc Trp His Thr Tyr Leu Pro Arg Leu Glu Ala Arg Asn Tyr Ile Gln Val 275 280 285	866
ttt gga cag gac act gag aac acg aag tca tat gtg aag agc aaa aaa Phe Gly Gln Asp Thr Glu Asn Thr Lys Ser Tyr Val Lys Ser Lys Lys 290 295 300	914
ctt tta gaa ctc gca aaa ttg gag ttc aac atc ttt caa tcc tta caa Leu Leu Glu Leu Ala Lys Leu Glu Phe Asn Ile Phe Gln Ser Leu Gln 305 310 315	962
aag agg gag tta gaa agt ctg gtc aga tgg tgg aaa gaa tcg ggt ttt Lys Arg Glu Leu Glu Ser Leu Val Arg Trp Trp Lys Glu Ser Gly Phe 320 325 330 335	1010
cct gag atg acc ttc tgc cga cat cgt cac gtg gaa tac tac act ttg Pro Glu Met Thr Phe Cys Arg His Arg His Val Glu Tyr Tyr Thr Leu 340 345 350	1058
gct tcc tgc att gcg ttc gag cct caa cat tct gga ttc aga ctc ggc Ala Ser Cys Ile Ala Phe Glu Pro Gln His Ser Gly Phe Arg Leu Gly 355 360 365	1106
ttt gcc aag acg tgt cat ctt atc acg gtt ctt gac gat atg tac gac Phe Ala Lys Thr Cys His Leu Ile Thr Val Leu Asp Asp Met Tyr Asp 370 375 380 385	1154
acc ttc ggc aca gta gac gag ctg gaa ctc ttc aca gcg aca atg aag Thr Phe Gly Thr Val Asp Glu Leu Glu Leu Phe Thr Ala Thr Met Lys 385 390 395	1202
aga tgg gat ccg tcc tcg ata gat tgc ctt cca gaa tat atg aaa gga Arg Trp Asp Pro Ser Ser Ile Asp Cys Leu Pro Glu Tyr Met Lys Gly 400 405 410 415	1250
gtg tac ata gcg gtt tac gac acc gta aat gaa atg gct cga gag gca Val Tyr Ile Ala Val Tyr Asp Thr Val Asn Glu Met Ala Arg Glu Ala 420 425 430	1298
gag gag gct caa ggc cga gat acg ctc aca tat gct cgg gaa gct tgg Glu Glu Ala Gln Gly Arg Asp Thr Leu Thr Tyr Ala Arg Glu Ala Trp 435 440 445	1346
gag gct tat att gat tcg tat atg caa gaa gca agg tgg atc gcc act	1394

Glu	Ala	Tyr	Ile	Asp	Ser	Tyr	Met	Gln	Glu	Ala	Arg	Trp	Ile	Ala	Thr		
	450						455					460					
ggt	tac	ctg	ccc	tcc	ttt	gat	gag	tac	tac	gag	aat	ggg	aaa	ggt	agc		1442
Gly	Tyr	Leu	Pro	Ser	Phe	Asp	Glu	Tyr	Tyr	Glu	Asn	Gly	Lys	Val	Ser		
	465					470					475						
tgt	ggt	cat	cgc	ata	tcc	gca	ttg	caa	ccc	att	ctg	aca	atg	gac	atc		1490
Cys	Gly	His	Arg	Ile	Ser	Ala	Leu	Gln	Pro	Ile	Leu	Thr	Met	Asp	Ile		
	480				485					490					495		
ccc	ttt	cct	gat	cat	atc	ctc	aag	gaa	ggt	gac	ttc	cca	tca	aag	ctt		1538
Pro	Phe	Pro	Asp	His	Ile	Leu	Lys	Glu	Val	Asp	Phe	Pro	Ser	Lys	Leu		
				500					505					510			
aac	gac	ttg	gca	tgt	gcc	atc	ctt	cga	tta	cga	ggt	gat	acg	cgg	tgc		1586
Asn	Asp	Leu	Ala	Cys	Ala	Ile	Leu	Arg	Leu	Arg	Gly	Asp	Thr	Arg	Cys		
			515					520					525				
tac	aag	gcg	gac	agg	gct	cgt	gga	gaa	gaa	gct	tcc	tct	ata	tca	tgt		1634
Tyr	Lys	Ala	Asp	Arg	Ala	Arg	Gly	Glu	Glu	Ala	Ser	Ser	Ile	Ser	Cys		
		530					535					540					
tat	atg	aaa	gac	aat	cct	gga	gta	tca	gag	gaa	gat	gct	ctc	gat	cat		1682
Tyr	Met	Lys	Asp	Asn	Pro	Gly	Val	Ser	Glu	Glu	Asp	Ala	Leu	Asp	His		
	545					550					555						
atc	aac	gcc	atg	atc	agt	gac	gta	atc	aaa	gga	tta	aat	tgg	gaa	ctt		1730
Ile	Asn	Ala	Met	Ile	Ser	Asp	Val	Ile	Lys	Gly	Leu	Asn	Trp	Glu	Leu		
	560				565					570					575		
ctc	aaa	cca	gac	atc	aat	ggt	ccc	atc	tcg	gcg	aag	aaa	cat	gct	ttt		1778
Leu	Lys	Pro	Asp	Ile	Asn	Val	Pro	Ile	Ser	Ala	Lys	Lys	His	Ala	Phe		
				580					585					590			
gac	atc	gcc	aga	gct	ttc	cat	tac	ggc	tac	aaa	tac	cga	gac	ggc	tac		1826
Asp	Ile	Ala	Arg	Ala	Phe	His	Tyr	Gly	Tyr	Lys	Tyr	Arg	Asp	Gly	Tyr		
			595					600					605				
agc	gtt	gcc	aac	gtt	gaa	acg	aag	agt	ttg	gtc	acg	aga	acc	ctc	ctt		1874
Ser	Val	Ala	Asn	Val	Glu	Thr	Lys	Ser	Leu	Val	Thr	Arg	Thr	Leu	Leu		
		610					615					620					
gaa	tct	gtg	cct	ttg	tag	caacagctca	aatctatgcc	ctatgctatg									1922
Glu	Ser	Val	Pro	Leu	*												
	625																
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<213> Abies grandis

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Ile Pro Ala Leu Gly Met Ser Arg Arg Gly Lys Ser Ile Thr Pro Ser
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Ile Ser Met Ser Ser Thr Thr Val Val Thr Asp Asp Gly Val Arg Arg
50 55 60
Arg Met Gly Asp Phe His Ser Asn Leu Trp Asp Asp Asp Val Ile Gln
65 70 75 80
Ser Leu Pro Thr Ala Tyr Glu Glu Lys Ser Tyr Leu Glu Arg Ala Glu
85 90 95
Lys Leu Ile Gly Glu Val Lys Asn Met Phe Asn Ser Met Ser Leu Glu
100 105 110
Asp Gly Glu Leu Met Ser Pro Leu Asn Asp Leu Ile Gln Arg Leu Trp
115 120 125
Ile Val Asp Ser Leu Glu Arg Leu Gly Ile His Arg His Phe Lys Asp
130 135 140
Glu Ile Lys Ser Ala Leu Asp Tyr Val Tyr Ser Tyr Trp Gly Glu Asn
145 150 155 160
Gly Ile Gly Cys Gly Arg Glu Ser Val Val Thr Asp Leu Asn Ser Thr
165 170 175
Ala Leu Gly Leu Arg Thr Leu Arg Leu His Gly Tyr Pro Val Ser Ser
180 185 190
Asp Val Phe Lys Ala Phe Lys Gly Gln Asn Gly Gln Phe Ser Cys Ser
195 200 205
Glu Asn Ile Gln Thr Asp Glu Ile Arg Gly Val Leu Asn Leu Phe
210 215 220
Arg Ala Ser Leu Ile Ala Phe Pro Gly Glu Lys Ile Met Asp Glu Ala
225 230 235 240
Glu Ile Phe Ser Thr Lys Tyr Leu Lys Glu Ala Leu Gln Lys Ile Pro
245 250 255
Val Ser Ser Leu Ser Arg Glu Ile Gly Asp Val Leu Glu Tyr Gly Trp
260 265 270
His Thr Tyr Leu Pro Arg Leu Glu Ala Arg Asn Tyr Ile Gln Val Phe
275 280 285
Gly Gln Asp Thr Glu Asn Thr Lys Ser Tyr Val Lys Ser Lys Lys Leu
290 295 300
Leu Glu Leu Ala Lys Leu Glu Phe Asn Ile Phe Gln Ser Leu Gln Lys
305 310 315 320
Arg Glu Leu Glu Ser Leu Val Arg Trp Trp Lys Glu Ser Gly Phe Pro
325 330 335
Glu Met Thr Phe Cys Arg His Arg His Val Glu Tyr Tyr Thr Leu Ala
340 345 350
Ser Cys Ile Ala Phe Glu Pro Gln His Ser Gly Phe Arg Leu Gly Phe
355 360 365
Ala Lys Thr Cys His Leu Ile Thr Val Leu Asp Asp Met Tyr Asp Thr
370 375 380
Phe Gly Thr Val Asp Glu Leu Glu Leu Phe Thr Ala Thr Met Lys Arg
385 390 395 400

Trp	Asp	Pro	Ser	Ser	Ile	Asp	Cys	Leu	Pro	Glu	Tyr	Met	Lys	Gly	Val	
				405					410					415		
Tyr	Ile	Ala	Val	Tyr	Asp	Thr	Val	Asn	Glu	Met	Ala	Arg	Glu	Ala	Glu	
			420					425					430			
Glu	Ala	Gln	Gly	Arg	Asp	Thr	Leu	Thr	Tyr	Ala	Arg	Glu	Ala	Trp	Glu	
		435					440					445				
Ala	Tyr	Ile	Asp	Ser	Tyr	Met	Gln	Glu	Ala	Arg	Trp	Ile	Ala	Thr	Gly	
	450				455						460					
Tyr	Leu	Pro	Ser	Phe	Asp	Glu	Tyr	Tyr	Glu	Asn	Gly	Lys	Val	Ser	Cys	
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Gly	His	Arg	Ile	Ser	Ala	Leu	Gln	Pro	Ile	Leu	Thr	Met	Asp	Ile	Pro	
			485					490						495		
Phe	Pro	Asp	His	Ile	Leu	Lys	Glu	Val	Asp	Phe	Pro	Ser	Lys	Leu	Asn	
			500					505					510			
Asp	Leu	Ala	Cys	Ala	Ile	Leu	Arg	Leu	Arg	Gly	Asp	Thr	Arg	Cys	Tyr	
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Lys	Ala	Asp	Arg	Ala	Arg	Gly	Glu	Glu	Ala	Ser	Ser	Ile	Ser	Cys	Tyr	
	530					535					540					
Met	Lys	Asp	Asn	Pro	Gly	Val	Ser	Glu	Glu	Asp	Ala	Leu	Asp	His	Ile	
545					550					555					560	
Asn	Ala	Met	Ile	Ser	Asp	Val	Ile	Lys	Gly	Leu	Asn	Trp	Glu	Leu	Leu	
			565					570						575		
Lys	Pro	Asp	Ile	Asn	Val	Pro	Ile	Ser	Ala	Lys	Lys	His	Ala	Phe	Asp	
			580					585					590			
Ile	Ala	Arg	Ala	Phe	His	Tyr	Gly	Tyr	Lys	Tyr	Arg	Asp	Gly	Tyr	Ser	
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Val	Ala	Asn	Val	Glu	Thr	Lys	Ser	Leu	Val	Thr	Arg	Thr	Leu	Leu	Glu	
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<210> 21
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 <213> *Mentha spicata*

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 <222> (29)...(1828)
 <223> 4S-limonene synthase

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			1				5									
gca	act	caa	atg	gcg	att	cct	agc	aac	cta	acg	aca	tgt	ctt	caa	ccc	100
Ala	Thr	Gln	Met	Ala	Ile	Pro	Ser	Asn	Leu	Thr	Thr	Cys	Leu	Gln	Pro	
	10					15					20					
tca	cac	ttc	aaa	tct	tct	cca	aaa	ctg	tta	tct	agc	act	aac	agt	agt	148
Ser	His	Phe	Lys	Ser	Ser	Pro	Lys	Leu	Leu	Ser	Ser	Thr	Asn	Ser	Ser	
	25				30					35					40	

agt	cgg	tct	cgc	ctc	cgt	gtg	tat	tgc	tcc	tcc	tcg	caa	ctc	act	act	196
Ser	Arg	Ser	Arg	Leu	Arg	Val	Tyr	Cys	Ser	Ser	Ser	Gln	Leu	Thr	Thr	
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gaa	aga	cga	tcc	gga	aac	tac	aac	cct	tct	cgt	tgg	gat	gtc	aac	ttc	244
Glu	Arg	Arg	Ser	Gly	Asn	Tyr	Asn	Pro	Ser	Arg	Trp	Asp	Val	Asn	Phe	
			60					65					70			
atc	caa	tcg	ctt	ctc	agt	gac	tat	aag	gag	gac	aaa	cac	gtg	att	agg	292
Ile	Gln	Ser	Leu	Leu	Ser	Asp	Tyr	Lys	Glu	Asp	Lys	His	Val	Ile	Arg	
		75					80					85				
gct	tct	gag	ctg	gtc	act	ttg	gtg	aag	atg	gaa	ctg	gag	aaa	gaa	acg	340
Ala	Ser	Glu	Leu	Val	Thr	Leu	Val	Lys	Met	Glu	Leu	Glu	Lys	Glu	Thr	
	90					95					100					
gat	caa	att	cga	caa	ctt	gag	ttg	atc	gat	gac	ttg	cag	agg	atg	ggg	388
Asp	Gln	Ile	Arg	Gln	Leu	Glu	Leu	Ile	Asp	Asp	Leu	Gln	Arg	Met	Gly	
105					110					115					120	
ctg	tcc	gat	cat	ttc	caa	aat	gag	ttc	aaa	gaa	atc	ttg	tcc	tct	ata	436
Leu	Ser	Asp	His	Phe	Gln	Asn	Glu	Phe	Lys	Glu	Ile	Leu	Ser	Ser	Ile	
				125					130					135		
tat	ctc	gac	cat	cac	tat	tac	aag	aac	cct	ttt	cca	aaa	gaa	gaa	agg	484
Tyr	Leu	Asp	His	His	Tyr	Tyr	Lys	Asn	Pro	Phe	Pro	Lys	Glu	Glu	Arg	
			140					145					150			
gat	ctc	tac	tcc	aca	tct	ctt	gca	ttt	agg	ctc	ctc	aga	gaa	cat	ggc	532
Asp	Leu	Tyr	Ser	Thr	Ser	Leu	Ala	Phe	Arg	Leu	Leu	Arg	Glu	His	Gly	
		155					160					165				
ttt	caa	gtc	gca	caa	gag	gta	ttc	gat	agt	ttc	aag	aac	gag	gag	ggc	580
Phe	Gln	Val	Ala	Gln	Glu	Val	Phe	Asp	Ser	Phe	Lys	Asn	Glu	Glu	Gly	
	170					175					180					
gag	ttc	aaa	gaa	agc	ctt	agc	gac	gac	acc	aga	gga	ttg	ttg	caa	ctg	628
Glu	Phe	Lys	Glu	Ser	Leu	Ser	Asp	Asp	Thr	Arg	Gly	Leu	Leu	Gln	Leu	
185					190					195					200	
tat	gaa	gct	tcc	ttt	ctg	ttg	acg	gaa	ggc	gaa	acc	acg	ctc	gag	tca	676
Tyr	Glu	Ala	Ser	Phe	Leu	Leu	Thr	Glu	Gly	Glu	Thr	Thr	Leu	Glu	Ser	
				205					210					215		
gcg	agg	gaa	ttc	gcc	acc	aaa	ttt	ttg	gag	gaa	aaa	gtg	aac	gag	ggc	724
Ala	Arg	Glu	Phe	Ala	Thr	Lys	Phe	Leu	Glu	Glu	Lys	Val	Asn	Glu	Gly	
			220					225					230			
ggc	gtt	gat	ggc	gac	ctt	tta	aca	aga	atc	gca	tat	tct	ttg	gac	atc	772
Gly	Val	Asp	Gly	Asp	Leu	Leu	Thr	Arg	Ile	Ala	Tyr	Ser	Leu	Asp	Ile	
		235					240					245				

cct Pro 250	ctt Leu 250	cat His	tgg Trp	agg Arg	att Ile	aaa Lys 255	agg Arg	cca Pro	aat Asn	gca Ala 260	cct Pro 260	gtg Val	tgg Trp	atc Ile	gaa Glu	820
tgg Trp 265	tat Tyr	agg Arg	aag Lys	agg Arg	ccc Pro 270	gac Asp	atg Met	aat Asn	cca Pro	gta Val 275	gtg Val	ttg Leu	gag Glu	ctt Leu	gcc Ala 280	868
ata Ile	ctc Leu	gac Asp	tta Leu	aat Asn 285	att Ile	gtt Val	caa Gln	gca Ala	caa Gln 290	ttt Phe	caa Gln	gaa Glu	gag Glu	ctc Leu 295	aaa Lys	916
gaa Glu	tcc Ser	ttc Phe	agg Arg 300	tgg Trp	tgg Trp	aga Arg	aat Asn	act Thr 305	ggg Gly	ttt Phe	gtt Val	gag Glu	aag Lys 310	ctg Leu	ccc Pro	964
ttc Phe	gca Ala	agg Arg 315	gat Asp	aga Arg	ctg Leu	gtg Val	gaa Glu 320	tgc Cys	tac Tyr	ttt Phe	tgg Trp	aat Asn 325	act Thr	ggg Gly	atc Ile	1012
atc Ile 330	gag Glu	cca Pro	cgt Arg	cag Gln	cat His	gca Ala 335	agt Ser	gca Ala	agg Arg	ata Ile	atg Met 340	atg Met	ggc Gly	aaa Lys	gtc Val	1060
aac Asn 345	gct Ala	ctg Leu	att Ile	acg Thr	gtg Val 350	atc Ile	gat Asp	gat Asp	att Ile	tat Tyr 355	gat Asp	gtc Val	tat Tyr	ggc Gly	acc Thr 360	1108
tta Leu	gaa Glu	gaa Glu	ctc Leu	gaa Glu 365	caa Gln	ttc Phe	act Thr	gac Asp	ctc Leu 370	att Ile	cga Arg	aga Arg	tgg Trp	gat Asp 375	ata Ile	1156
aac Asn	tca Ser	atc Ile	gac Asp 380	caa Gln	ctt Leu	ccc Pro	gat Asp	tac Tyr 385	atg Met	caa Gln	ctg Leu	tgc Cys	ttt Phe 390	ctt Leu	gca Ala	1204
ctc Leu	aac Asn	aac Asn 395	ttc Phe	gtc Val	gat Asp	gat Asp	aca Thr 400	tcg Ser	tac Tyr	gat Asp	gtt Val	atg Met 405	aag Lys	gag Glu	aaa Lys	1252
ggc Gly 410	gtc Val	aac Asn	gtt Val	ata Ile	ccc Pro	tac Tyr 415	ctg Leu	cgg Arg	caa Gln	tcg Ser	tgg Trp 420	gtt Val	gat Asp	ttg Leu	gcg Ala	1300
gat Asp 425	aag Lys	tat Tyr	atg Met	gta Val	gag Glu 430	gca Ala	cgg Arg	tgg Trp	ttc Phe	tac Tyr 435	ggc Gly	ggg Gly	cac His	aaa Lys	cca Pro 440	1348
agt Ser	ttg Leu	gaa Glu	gag Glu	tat Tyr 445	ttg Leu	gag Glu	aac Asn	tca Ser	tgg Trp 450	cag Gln	tcg Ser	ata Ile	agt Ser	ggg Gly 455	ccc Pro	1396
tgt atg	tta aca	acg cac	ata ttc	ttc cga	gta aca	gat tcg	ttc aca	aag								1444

Cys	Met	Leu	Thr	His	Ile	Phe	Phe	Arg	Val	Thr	Asp	Ser	Phe	Thr	Lys		
			460					465					470				
gag	acc	gtc	gac	agt	ttg	tac	aaa	tac	cac	gat	tta	gtt	cgt	tgg	tca	1492	
Glu	Thr	Val	Asp	Ser	Leu	Tyr	Lys	Tyr	His	Asp	Leu	Val	Arg	Trp	Ser		
		475					480					485					
tcc	ttc	gtt	ctg	cgg	ctt	gct	gat	gat	ttg	gga	acc	tcg	gtg	gaa	gag	1540	
Ser	Phe	Val	Leu	Arg	Leu	Ala	Asp	Asp	Leu	Gly	Thr	Ser	Val	Glu	Glu		
		490				495					500						
gtg	agc	aga	ggg	gat	gtg	ccg	aaa	tca	ctt	cag	tgc	tac	atg	agt	gac	1588	
Val	Ser	Arg	Gly	Asp	Val	Pro	Lys	Ser	Leu	Gln	Cys	Tyr	Met	Ser	Asp		
505					510					515					520		
tac	aat	gca	tcg	gag	gcg	gag	gcg	cgg	aag	cac	gtg	aaa	tgg	ctg	ata	1636	
Tyr	Asn	Ala	Ser	Glu	Ala	Glu	Ala	Arg	Lys	His	Val	Lys	Trp	Leu	Ile		
				525					530					535			
gcg	gag	gtg	tgg	aag	aag	atg	aat	gcg	gag	agg	gtg	tcg	aag	gat	tct	1684	
Ala	Glu	Val	Trp	Lys	Lys	Met	Asn	Ala	Glu	Arg	Val	Ser	Lys	Asp	Ser		
			540					545					550				
cca	ttc	ggc	aaa	gat	ttt	ata	gga	tgt	gca	gtt	gat	tta	gga	agg	atg	1732	
Pro	Phe	Gly	Lys	Asp	Phe	Ile	Gly	Cys	Ala	Val	Asp	Leu	Gly	Arg	Met		
		555					560					565					
gcg	cag	ttg	atg	tac	cat	aat	gga	gat	ggg	cac	ggc	aca	caa	cac	cct	1780	
Ala	Gln	Leu	Met	Tyr	His	Asn	Gly	Asp	Gly	His	Gly	Thr	Gln	His	Pro		
		570				575					580						
att	ata	cat	caa	caa	atg	acc	aga	acc	tta	ttc	gag	ccc	ttt	gca	tga	1828	
Ile	Ile	His	Gln	Gln	Met	Thr	Arg	Thr	Leu	Phe	Glu	Pro	Phe	Ala	*		
585					590					595							
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gccaccacgt	gagcacaagg	gagagtctgt	cgtcgtttat	ggatgaacta	ttcaattttt	2008											
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<210> 22
 <211> 599
 <212> PRT
 <213> *Mentha spicata*

<400> 22
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 Asn Leu Thr Thr Cys Leu Gln Pro Ser His Phe Lys Ser Ser Pro Lys
 20 25 30
 Leu Leu Ser Ser Thr Asn Ser Ser Ser Arg Ser Arg Leu Arg Val Tyr

		35				40				45				
Cys	Ser	Ser	Ser-Gln	Leu	Thr	Thr	Glu	Arg	Arg	Ser	Gly	Asn	Tyr	Asn
	50				55					60				
Pro	Ser	Arg	Trp	Asp	Val	Asn	Phe	Ile	Gln	Ser	Leu	Leu	Ser	Asp
65					70					75				80
Lys	Glu	Asp	Lys	His	Val	Ile	Arg	Ala	Ser	Glu	Leu	Val	Thr	Leu
				85					90					95
Lys	Met	Glu	Leu	Glu	Lys	Glu	Thr	Asp	Gln	Ile	Arg	Gln	Leu	Glu
			100					105					110	Leu
Ile	Asp	Asp	Leu	Gln	Arg	Met	Gly	Leu	Ser	Asp	His	Phe	Gln	Asn
		115					120					125		Glu
Phe	Lys	Glu	Ile	Leu	Ser	Ser	Ile	Tyr	Leu	Asp	His	His	Tyr	Tyr
	130					135					140			Lys
Asn	Pro	Phe	Pro	Lys	Glu	Glu	Arg	Asp	Leu	Tyr	Ser	Thr	Ser	Leu
145					150					155				Ala
Phe	Arg	Leu	Leu	Arg	Glu	His	Gly	Phe	Gln	Val	Ala	Gln	Glu	Val
				165					170					Phe
Asp	Ser	Phe	Lys	Asn	Glu	Glu	Gly	Glu	Phe	Lys	Glu	Ser	Leu	Ser
			180					185					190	Asp
Asp	Thr	Arg	Gly	Leu	Leu	Gln	Leu	Tyr	Glu	Ala	Ser	Phe	Leu	Leu
	195						200					205		Thr
Glu	Gly	Glu	Thr	Thr	Leu	Glu	Ser	Ala	Arg	Glu	Phe	Ala	Thr	Lys
	210					215					220			Phe
Leu	Glu	Glu	Lys	Val	Asn	Glu	Gly	Gly	Val	Asp	Gly	Asp	Leu	Leu
225					230					235				Thr
Arg	Ile	Ala	Tyr	Ser	Leu	Asp	Ile	Pro	Leu	His	Trp	Arg	Ile	Lys
				245					250					Arg
Pro	Asn	Ala	Pro	Val	Trp	Ile	Glu	Trp	Tyr	Arg	Lys	Arg	Pro	Asp
			260					265					270	Met
Asn	Pro	Val	Val	Leu	Glu	Leu	Ala	Ile	Leu	Asp	Leu	Asn	Ile	Val
		275					280					285		Gln
Ala	Gln	Phe	Gln	Glu	Glu	Leu	Lys	Glu	Ser	Phe	Arg	Trp	Trp	Arg
	290					295					300			Asn
Thr	Gly	Phe	Val	Glu	Lys	Leu	Pro	Phe	Ala	Arg	Asp	Arg	Leu	Val
305					310					315				Glu
Cys	Tyr	Phe	Trp	Asn	Thr	Gly	Ile	Ile	Glu	Pro	Arg	Gln	His	Ala
				325					330					Ser
Ala	Arg	Ile	Met	Met	Gly	Lys	Val	Asn	Ala	Leu	Ile	Thr	Val	Ile
			340					345					350	Asp
Asp	Ile	Tyr	Asp	Val	Tyr	Gly	Thr	Leu	Glu	Glu	Leu	Glu	Gln	Phe
	355						360					365		Thr
Asp	Leu	Ile	Arg	Arg	Trp	Asp	Ile	Asn	Ser	Ile	Asp	Gln	Leu	Pro
	370					375					380			Asp
Tyr	Met	Gln	Leu	Cys	Phe	Leu	Ala	Leu	Asn	Asn	Phe	Val	Asp	Asp
385					390					395				Thr
Ser	Tyr	Asp	Val	Met	Lys	Glu	Lys	Gly	Val	Asn	Val	Ile	Pro	Tyr
				405					410					Leu
Arg	Gln	Ser	Trp	Val	Asp	Leu	Ala	Asp	Lys	Tyr	Met	Val	Glu	Ala
			420					425					430	Arg
Trp	Phe	Tyr	Gly	Gly	His	Lys	Pro	Ser	Leu	Glu	Glu	Tyr	Leu	Glu
	435						440					445		Asn
Ser	Trp	Gln	Ser	Ile	Ser	Gly	Pro	Cys	Met	Leu	Thr	His	Ile	Phe
	450					455								Phe

Arg	Val	Thr	Asp	Ser	Phe	Thr	Lys	Glu	Thr	Val	Asp	Ser	Leu	Tyr	Lys
465					470					475					480
Tyr	His	Asp	Leu	Val	Arg	Trp	Ser	Ser	Phe	Val	Leu	Arg	Leu	Ala	Asp
				485					490					495	
Asp	Leu	Gly	Thr	Ser	Val	Glu	Glu	Val	Ser	Arg	Gly	Asp	Val	Pro	Lys
			500					505					510		
Ser	Leu	Gln	Cys	Tyr	Met	Ser	Asp	Tyr	Asn	Ala	Ser	Glu	Ala	Glu	Ala
		515					520					525			
Arg	Lys	His	Val	Lys	Trp	Leu	Ile	Ala	Glu	Val	Trp	Lys	Lys	Met	Asn
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Ala	Glu	Arg	Val	Ser	Lys	Asp	Ser	Pro	Phe	Gly	Lys	Asp	Phe	Ile	Gly
545					550					555					560
Cys	Ala	Val	Asp	Leu	Gly	Arg	Met	Ala	Gln	Leu	Met	Tyr	His	Asn	Gly
				565					570					575	
Asp	Gly	His	Gly	Thr	Gln	His	Pro	Ile	Ile	His	Gln	Gln	Met	Thr	Arg
			580					585					590		
Thr	Leu	Phe	Glu	Pro	Phe	Ala									
			595												

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 <211> 1967
 <212> DNA
 <213> Salvia officinalis

<220>
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 <222> (13)...(1788)
 <223> 1,8-cineole synthase

<400> 23

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gcc	aaa	att	ttt	cac	aat	aac	tta	ttc	agc	gtg	att	tca	aaa	cga	cat	99
Ala	Lys	Ile	Phe	His	Asn	Asn	Leu	Phe	Ser	Val	Ile	Ser	Lys	Arg	His	
	15					20					25					
cgt	ttc	agt	act	aca	atc	acc	act	cgt	ggt	ggc	agg	tgg	gca	cat	tgc	147
Arg	Phe	Ser	Thr	Thr	Ile	Thr	Thr	Arg	Gly	Gly	Arg	Trp	Ala	His	Cys	
	30				35					40					45	
tca	cta	caa	atg	ggt	aat	gag	atc	caa	act	gga	cga	cga	act	gga	ggc	195
Ser	Leu	Gln	Met	Gly	Asn	Glu	Ile	Gln	Thr	Gly	Arg	Arg	Thr	Gly	Gly	
				50					55					60		
tac	cag	cct	acc	ctt	tgg	gat	ttc	agc	acc	att	caa	ttg	ttc	gac	tct	243
Tyr	Gln	Pro	Thr	Leu	Trp	Asp	Phe	Ser	Thr	Ile	Gln	Leu	Phe	Asp	Ser	
			65					70					75			
gag	tat	aag	gaa	gag	aag	cac	ttg	atg	agg	gcc	gca	ggt	atg	ata	gcc	291
Glu	Tyr	Lys	Glu	Glu	Lys	His	Leu	Met	Arg	Ala	Ala	Gly	Met	Ile	Ala	
		80					85					90				

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Gln	Val	Asn	Met	Leu	Leu	Gln	Glu	Glu	Val	Asp	Ser	Ile	Gln	Arg	Leu	
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110					115					120					125	
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Arg	Glu	Ile	Val	Glu	Ile	Leu	Asn	Ser	Lys	Tyr	Tyr	Thr	Asn	Asn	Glu	
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ata	gat	gaa	agt	gat	cta	tac	tca	aca	gcc	ctt	aga	ttc	aag	ctc	cta	483
Ile	Asp	Glu	Ser	Asp	Leu	Tyr	Ser	Thr	Ala	Leu	Arg	Phe	Lys	Leu	Leu	
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aga	caa	tac	gat	ttt	agc	gtc	tct	caa	gag	gta	ttt	gat	tgt	ttc	aag	531
Arg	Gln	Tyr	Asp	Phe	Ser	Val	Ser	Gln	Glu	Val	Phe	Asp	Cys	Phe	Lys	
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Asn	Asp	Lys	Gly	Thr	Asp	Phe	Lys	Pro	Ser	Leu	Val	Asp	Asp	Thr	Arg	
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Gly	Leu	Leu	Gln	Leu	Tyr	Glu	Ala	Ser	Phe	Leu	Ser	Ala	Gln	Gly	Glu	
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aga	gta	cta	ggt	gat	aaa	gac	att	aat	ctc	tta	tca	tca	att	gaa	cgt	723
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Ala	Leu	Glu	Leu	Pro	Thr	His	Trp	Arg	Val	Gln	Met	Pro	Asn	Ala	Arg	
		240					245					250				
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Ser	Phe	Ile	Asp	Ala	Tyr	Lys	Arg	Arg	Pro	Asp	Met	Asn	Pro	Thr	Val	
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Gln	Glu	Leu	Lys	Glu	Ala	Ser	Arg	Trp	Trp	Asn	Ser	Thr	Gly	Leu	Val	
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aga Arg	tgg Trp	gat Asp	att Ile	gaa Glu 370	tca Ser	atg Met	aag Lys	caa Gln	ctc Leu 375	cct Pro	cct Pro	tac Tyr	atg Met	caa Gln 380	ata Ile	1155
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ctt Leu	agg Arg	gat Asp 400	aaa Lys	ggt Gly	ttc Phe	aac Asn	tcc Ser 405	acc Thr	cca Pro	tat Tyr	cta Leu	cga Arg 410	aaa Lys	gcg Ala	tgg Trp	1251
gtt Val 415	gat Asp	ttg Leu	gtt Val	gag Glu	tca Ser	tat Tyr 420	cta Leu	ata Ile	gag Glu	gca Ala	aag Lys 425	tgg Trp	tac Tyr	tac Tyr	atg Met	1299
gga Gly 430	cat His	aaa Lys	cct Pro	agt Ser	ttg Leu 435	gaa Glu	gaa Glu	tat Tyr	atg Met	aag Lys 440	aat Asn	agt Ser	tgg Trp	ata Ile	tca Ser 445	1347
atc Ile	gga Gly	ggc Gly	atc Ile	ccc Pro	att Ile	cta Leu	tct Ser	cat His	cta Leu	ttt Phe	ttc Phe	cgg Arg	cta Leu	aca Thr 460	gat Asp	1395
tcg Ser	att Ile	gag Glu	gaa Glu 465	gag Glu	gat Asp	gct Ala	gag Glu	agt Ser 470	atg Met	cat His	aaa Lys	tac Tyr	cat His 475	gat Asp	att Ile	1443
gtt Val	cgt Arg	gca Ala 480	tcg Ser	tgt Cys	act Thr	att Ile	cta Leu 485	agg Arg	ctt Leu	gct Ala	gat Asp	gat Asp 490	atg Met	gga Gly	aca Thr	1491
tcg Ser	ctg Leu	gat Asp	gag Glu	gtg Val	gag Glu	aga Arg 500	ggc Gly	gac Asp	gtg Val	ccc Pro	aaa Lys 505	tca Ser	gtt Val	cag Gln	tgc Cys	1539
tac Ile	atg Thr	aat Asn	gag Glu	aag Lys	aat Asn	gct Ala	tcg Glu	gaa Glu	gaa Glu	gaa Glu	gcg Arg	cga Arg	gag Glu	cat Tyr	gtg Trp	1587

[illegible]

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Thr	Thr	Ile 35	Thr	Thr	Arg	Gly	Gly 40	Arg	Trp	Ala	His	Cys 45	Ser	Leu	Gln
Met	Gly 50	Asn	Glu	Ile	Gln	Thr 55	Gly	Arg	Arg	Thr	Gly 60	Gly	Tyr	Gln	Pro
Thr 65	Leu	Trp	Asp	Phe 70	Ser	Thr	Ile	Gln	Leu	Phe 75	Asp	Ser	Glu	Tyr	Lys 80
Glu	Glu	Lys	His 85	Leu	Met	Arg	Ala	Ala	Gly 90	Met	Ile	Ala	Gln	Val 95	Asn
Met	Leu	Leu	Gln 100	Glu	Glu	Val	Asp	Ser 105	Ile	Gln	Arg	Leu	Glu 110	Leu	Ile
Asp	Asp	Leu 115	Arg	Arg	Leu	Gly	Ile 120	Ser	Cys	His	Phe	Asp 125	Arg	Glu	Ile
Val	Glu 130	Ile	Leu	Asn	Ser	Lys 135	Tyr	Tyr	Thr	Asn	Asn 140	Glu	Ile	Asp	Glu
Ser 145	Asp	Leu	Tyr	Ser	Thr 150	Ala	Leu	Arg	Phe	Lys 155	Leu	Leu	Arg	Gln	Tyr 160

Asp	Phe	Ser	Val	Ser	Gln	Glu	Val	Phe	Asp	Cys	Phe	Lys	Asn	Asp	Lys	165	170	175
Gly	Thr	Asp	Phe	Lys	Pro	Ser	Leu	Val	Asp	Asp	Thr	Arg	Gly	Leu	Leu	180	185	190
Gln	Leu	Tyr	Glu	Ala	Ser	Phe	Leu	Ser	Ala	Gln	Gly	Glu	Glu	Thr	Leu	195	200	205
His	Leu	Ala	Arg	Asp	Phe	Ala	Thr	Lys	Phe	Leu	His	Lys	Arg	Val	Leu	210	215	220
Val	Asp	Lys	Asp	Ile	Asn	Leu	Leu	Ser	Ser	Ile	Glu	Arg	Ala	Leu	Glu	225	230	235
Leu	Pro	Thr	His	Trp	Arg	Val	Gln	Met	Pro	Asn	Ala	Arg	Ser	Phe	Ile	245	250	255
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Ala	Lys	Leu	Asp	Phe	Asn	Met	Val	Gln	Ala	Gln	Phe	Gln	Gln	Glu	Leu	275	280	285
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Ile	Asn	Ala	Leu	Val	Thr	Thr	Ile	Asp	Asp	Val	Phe	Asp	Ile	Tyr	Gly	340	345	350
Thr	Leu	Glu	Glu	Leu	Gln	Leu	Phe	Thr	Thr	Ala	Ile	Gln	Arg	Trp	Asp	355	360	365
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Pro	Ser	Leu	Glu	Glu	Tyr	Met	Lys	Asn	Ser	Trp	Ile	Ser	Ile	Gly	Gly	435	440	445
Ile	Pro	Ile	Leu	Ser	His	Leu	Phe	Phe	Arg	Leu	Thr	Asp	Ser	Ile	Glu	450	455	460
Glu	Glu	Asp	Ala	Glu	Ser	Met	His	Lys	Tyr	His	Asp	Ile	Val	Arg	Ala	465	470	475
Ser	Cys	Thr	Ile	Leu	Arg	Leu	Ala	Asp	Asp	Met	Gly	Thr	Ser	Leu	Asp	485	490	495
Glu	Val	Glu	Arg	Gly	Asp	Val	Pro	Lys	Ser	Val	Gln	Cys	Tyr	Met	Asn	500	505	510
Glu	Lys	Asn	Ala	Ser	Glu	Glu	Glu	Ala	Arg	Glu	His	Val	Arg	Ser	Leu	515	520	525
Ile	Asp	Gln	Thr	Trp	Lys	Met	Met	Asn	Lys	Glu	Met	Met	Thr	Ser	Ser	530	535	540
Phe	Ser	Lys	Tyr	Phe	Val	Gln	Val	Ser	Ala	Asn	Leu	Ala	Arg	Met	Ala	545	550	555
Gln	Trp	Ile	Tyr	Gln	His	Glu	Ser	Asp	Gly	Phe	Gly	Met	Gln	His	Ser	565	570	575
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580

585

590

<210> 25

<211> 2024

<212> DNA

<213> *Salvia officinalis*

<220>

<221> CDS

<222> (11)...(1807)

<223> (+)-bornyl diphosphate synthase

<400> 25

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Pro	Leu	Asn	Cys	Leu	His	Asn	Leu	Glu	Arg	Arg	Pro	Ser	Lys	Ala	Leu	
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ctt	gtc	cct	tgc	act	gca	ccc	acc	gct	cgc	ctc	cgg	gca	tct	tgc	tcc	145
Leu	Val	Pro	Cys	Thr	Ala	Pro	Thr	Ala	Arg	Leu	Arg	Ala	Ser	Cys	Ser	
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Ser	Lys	Leu	Gln	Glu	Ala	His	Gln	Ile	Arg	Arg	Ser	Gly	Asn	Tyr	Gln	
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Pro	Ala	Leu	Trp	Asp	Ser	Asn	Tyr	Ile	Gln	Ser	Leu	Asn	Thr	Pro	Tyr	
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Thr	Glu	Glu	Arg	His	Leu	Asp	Arg	Lys	Ala	Glu	Leu	Ile	Val	Gln	Val	
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Cys	Phe	Lys	Asn	Glu	Lys	Gly	Ile	Asp	Phe	Lys	Ala	Ser	Leu	Ala	Gln	
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Gln	Ser	Val	Glu	Ala	Arg	Trp	Phe	Ile	Asp	Ala	Tyr	Ala	Arg	Arg	Pro	
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Gly	Tyr	Gln	Arg	Lys	Met	Ala	Ala	Thr	Ile	Ile	Val	Leu	Ala	Thr	Val	
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Asp	Met	Asn	Thr	Ala	Ile	Ala	Ala	Gly	Tyr	Pro	Phe	Pro	Asp	Gly	Met	
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Val	Ala	Gly	Ala	Ala	Asn	Ile	Gly	Arg	Val	Ala	Gln	Phe	Ile	Tyr	Leu	
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575

580

585

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 590 595

1827

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1887

1947

2007

2024

<210> 26

<211> 598

<212> PRT

<213> Salvia officinalis

<400> 26

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Cys	Leu	His	Asn	Leu	Glu	Arg	Arg	Pro	Ser	Lys	Ala	Leu	Leu	Val	Pro
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Cys	Thr	Ala	Pro	Thr	Ala	Arg	Leu	Arg	Ala	Ser	Cys	Ser	Ser	Lys	Leu
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Gln	Glu	Ala	His	Gln	Ile	Arg	Arg	Ser	Gly	Asn	Tyr	Gln	Pro	Ala	Leu
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Trp	Asp	Ser	Asn	Tyr	Ile	Gln	Ser	Leu	Asn	Thr	Pro	Tyr	Thr	Glu	Glu
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Arg	His	Leu	Asp	Arg	Lys	Ala	Glu	Leu	Ile	Val	Gln	Val	Arg	Ile	Leu
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Arg	Gln	His	Gly	Phe	Asn	Ile	Ser	Gln	Asp	Val	Phe	Asn	Cys	Phe	Lys
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Pro	Leu	Ile	Phe	Glu	Leu	Ala	Lys	Leu	Asn	Phe	Asn	Ile	Ile	Gln	Ala
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Phe	Phe	Trp	Ala	Val	Gly	Met	Phe	Glu	Pro	His	Gln	His	Gly	Tyr	Gln
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Phe	Ala	Asn	Ala	Ser	His	Asp	Thr	Ala	Val	Ile	Asp	Ser	Leu	Tyr	Gln
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<211> 1959

<212> DNA

<213> Mentha x piperita

<220>

<221> CDS

<222> (71)...(1723)

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Ile	Asn	Ala	Ala	Glu	Asp	Asp	Gly	Phe	Asp	Leu	Phe	Ala	Thr	Ala	Leu	
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Arg	Phe	Arg	Leu	Leu	Arg	Gln	His	Gln	Arg	His	Val	Ser	Cys	Asp	Val	
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Asn	Asn	Val	Glu	Gly	Leu	Leu	Ser	Leu	Tyr	Glu	Ala	Ala	His	Val	Gly	
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Phe	Arg	Glu	Glu	Arg	Ile	Leu	Gln	Glu	Ala	Val	Asn	Phe	Thr	Arg	His	
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cac	ttg	gaa	gga	gca	gag	tta	gat	cag	tct	cca	tta	ttg	att	aga	gag	637
His	Leu	Glu	Gly	Ala	Glu	Leu	Asp	Gln	Ser	Pro	Leu	Leu	Ile	Arg	Glu	
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Lys	Val	Lys	Arg	Ala	Leu	Glu	His	Pro	Leu	His	Arg	Asp	Phe	Pro	Ile	
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Asp	Glu	Leu	Leu	Leu	Lys	Leu	Ser	Lys	Val	Asn	Phe	Lys	Phe	Met	Gln	
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Asn	Leu	Tyr	Lys	Glu	Glu	Leu	Ser	Gln	Leu	Ser	Arg	Trp	Trp	Asn	Thr	
		240					245					250				
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Trp	Asn	Leu	Lys	Ser	Lys	Leu	Pro	Tyr	Ala	Arg	Asp	Arg	Val	Val	Glu	
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Ala	Tyr	Val	Trp	Gly	Val	Gly	Tyr	His	Tyr	Glu	Pro	Gln	Tyr	Ser	Tyr	
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Val	Arg	Met	Gly	Leu	Ala	Lys	Gly	Val	Leu	Ile	Cys	Gly	Ile	Met	Asp	
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gat	aca	tat	gat	aat	tat	gct	aca	ctc	aat	gaa	gct	caa	ctt	ttt	act	1021
Asp	Thr	Tyr	Asp	Asn	Tyr	Ala	Thr	Leu	Asn	Glu	Ala	Gln	Leu	Phe	Thr	
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Gln	Val	Leu	Asp	Lys	Trp	Asp	Arg	Asp	Glu	Ala	Glu	Arg	Leu	Pro	Glu	
		320					325					330				
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Tyr	Met	Lys	Ile	Val	Tyr	Arg	Phe	Ile	Leu	Ser	Ile	Tyr	Glu	Asn	Tyr	
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Glu	Arg	Asp	Ala	Ala	Lys	Leu	Gly	Lys	Ser	Phe	Ala	Ala	Pro	Tyr	Phe	
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aag	gaa	acc	gtg	aaa	caa	ctg	gca	agg	gca	ttt	aat	gag	gag	cag	aag	1213
Lys	Glu	Thr	Val	Lys	Gln	Leu	Ala	Arg	Ala	Phe	Asn	Glu	Glu	Gln	Lys	
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Trp	Val	Met	Glu	Arg	Gln	Leu	Pro	Ser	Phe	Gln	Asp	Tyr	Val	Lys	Asn	
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Ser	Glu	Lys	Thr	Ser	Cys	Ile	Tyr	Thr	Met	Phe	Ala	Ser	Ile	Ile	Pro	
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ggc	ttg	aaa	tct	gtt	acc	caa	gaa	acc	att	gat	tgg	atc	aag	agt	gaa	1357
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415	420	425	
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acc agc tct cag ctc cgt gaa agc aaa gga ggg gaa atg ctg act gcg Thr Ser Ser Gln Leu Arg Glu Ser Lys Gly Gly Glu Met Leu Thr Ala 450 455 460			1453
ttg gat ttc cac atg aaa gaa tat ggt ctg acg aag gaa gag gcg gca Leu Asp Phe His Met Lys Glu Tyr Gly Leu Thr Lys Glu Glu Ala Ala 465 470 475			1501
tct aag ttt gaa gga ttg gtt gag gaa aca tgg aag gat ata aac aag Ser Lys Phe Glu Gly Leu Val Glu Glu Thr Trp Lys Asp Ile Asn Lys 480 485 490			1549
gaa ttc ata gcc aca act aat tat aat gtg ggt aga gaa att gcc atc Glu Phe Ile Ala Thr Thr Asn Tyr Asn Val Gly Arg Glu Ile Ala Ile 495 500 505			1597
aca ttc ctc aac tac gct cgg ata tgt gaa gcc agt tac agc aaa act Thr Phe Leu Asn Tyr Ala Arg Ile Cys Glu Ala Ser Tyr Ser Lys Thr 510 515 520 525			1645
gac gga gac gct tat tca gat cct aat gtt gcc aag gca aat gtc gtt Asp Gly Asp Ala Tyr Ser Asp Pro Asn Val Ala Lys Ala Asn Val Val 530 535 540			1693
gct ctc ttt gtt gat gcc ata gtc ttt tga tttgcataat caaagaccct Ala Leu Phe Val Asp Ala Ile Val Phe * 545 550			1743
ataattataa ttatatgtgt ttaagaaact aataagcttg ctttatgtat agttgtcaat tgaataataa tgtattaatt agtagagtta agaagttata aagaataaag aggagctggg agacgtaaac aagaaataat gtgtcaaaat aacttcaact ttttcaagaa taaagaattg gaagagacca atatatacaa aaaaaaaaaa aaaaaa			1803 1863 1923 1959

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Phe	Ser	Leu	Asp	Asp	Lys	Glu	Gln	Gln	Lys	Cys	Ser	Glu	Thr	Ile	Glu
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Ala	Leu	Lys	Gln	Glu	Ala	Arg	Gly	Met	Leu	Met	Ala	Ala	Thr	Thr	Pro
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Ala	Glu	Asp	Asp	Gly	Phe	Asp	Leu	Phe	Ala	Thr	Ala	Leu	Arg	Phe	Arg
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Glu	Arg	Ile	Leu	Gln	Glu	Ala	Val	Asn	Phe	Thr	Arg	His	His	Leu	Glu
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Gly	Ala	Glu	Leu	Asp	Gln	Ser	Pro	Leu	Leu	Ile	Arg	Glu	Lys	Val	Lys
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Leu	Leu	Lys	Leu	Ser	Lys	Val	Asn	Phe	Lys	Phe	Met	Gln	Asn	Leu	Tyr
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Lys	Glu	Glu	Leu	Ser	Gln	Leu	Ser	Arg	Trp	Trp	Asn	Thr	Trp	Asn	Leu
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Lys	Ser	Lys	Leu	Pro	Tyr	Ala	Arg	Asp	Arg	Val	Val	Glu	Ala	Tyr	Val
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Trp	Gly	Val	Gly	Tyr	His	Tyr	Glu	Pro	Gln	Tyr	Ser	Tyr	Val	Arg	Met
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Asp	Lys	Trp	Asp	Arg	Asp	Glu	Ala	Glu	Arg	Leu	Pro	Glu	Tyr	Met	Lys
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Thr	Ser	Cys	Ile	Tyr	Thr	Met	Phe	Ala	Ser	Ile	Ile	Pro	Gly	Leu	Lys
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Glu	Gly	Leu	Val	Glu	Glu	Thr	Trp	Lys	Asp	Ile	Asn	Lys	Glu	Phe	Ile

Ala	Thr	Thr	Asn	485	Tyr	Asn	Val	Gly	Arg	490	Glu	Ile	Ala	Ile	Thr	495	Phe	Leu
Asn	Tyr	Ala	500	Arg	Ile	Cys	Glu	Ala	505	Ser	Tyr	Ser	Lys	Thr	510	Asp	Gly	Asp
Ala	Tyr	515	Ser	Asp	Pro	Asn	Val	520	Ala	Lys	Ala	Asn	Val	525	Val	Ala	Leu	Phe
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cct tcc atg agc atc agt ttg gcc acc gct gca cct gat gat ggt gta Pro Ser Met Ser Ile Ser Leu Ala Thr Ala Ala Pro Asp Asp Gly Val 50 55 60																		254
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			130					135					140			
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Lys	Asn	Glu	Ile	Thr	Ser	Ala	Leu	Asp	Tyr	Val	Phe	Arg	Tyr	Trp	Glu	
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Glu	Asn	Gly	Ile	Gly	Cys	Gly	Arg	Asp	Ser	Ile	Val	Thr	Asp	Leu	Asn	
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Val	Ile	Asp	Asp	Ile	Ala	Thr	Tyr	Glu	Val	Glu	Lys	Gly	Arg	Gly	Gln	
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Ile	Ala	Thr	Gly	Ile	Glu	Cys	Tyr	Met	Arg	Asp	Tyr	Gly	Val	Ser	Thr	
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gaa	aag	gcc	atg	gaa	aaa	ttc	caa	gaa	atg	gct	gag	aca	gca	tgg	aag	1547
Glu	Lys	Ala	Met	Glu	Lys	Phe	Gln	Glu	Met	Ala	Glu	Thr	Ala	Trp	Lys	
			485					490					495			
gat	gta	aat	gaa	gga	atc	ctt	cga	cca	act	ccc	gtc	tct	aca	gag	att	1595
Asp	Val	Asn	Glu	Gly	Ile	Leu	Arg	Pro	Thr	Pro	Val	Ser	Thr	Glu	Ile	
		500					505					510				
ctc	act	cgc	att	ctc	aat	ctt	gct	cgc	att	atc	gat	gtt	act	tat	aag	1643
Leu	Thr	Arg	Ile	Leu	Asn	Leu	Ala	Arg	Ile	Ile	Asp	Val	Thr	Tyr	Lys	
	515					520					525					
cac	aat	caa	gat	gga	tac	act	cat	ccg	gaa	aaa	gta	cta	aaa	cct	cat	1691
His	Asn	Gln	Asp	Gly	Tyr	Thr	His	Pro	Glu	Lys	Val	Leu	Lys	Pro	His	
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1737

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1797
 1857
 1917
 1944

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 Ile Glu Thr Leu Lys Glu Gln Ser Arg Ile Ile Leu Ser Ala Ser Ser
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 Arg Arg Thr Leu Ala Glu Lys Leu Asp Leu Ile Asp Ile Val Glu Arg
 65 70 75 80
 Leu Gly Ile Ala Tyr His Phe Glu Lys Gln Ile Asp Asp Met Leu Asp
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 Gln Phe Tyr Lys Ala Asp Pro Asn Phe Glu Ala His Glu Tyr Asn Asp
 100 105 110
 Leu Gln Thr Leu Ser Val Gln Phe Arg Leu Leu Arg Gln His Gly Tyr
 115 120 125
 Asn Ile Ser Pro Lys Leu Phe Ile Arg Phe Gln Asp Ala Lys Gly Lys
 130 135 140
 Phe Lys Glu Ser Leu Cys Asn Asp Ile Lys Gly Leu Leu Asn Leu Tyr
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 Glu Ala Ser His Val Arg Thr His Gly Glu Asp Ile Leu Glu Glu Ala
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 Leu Ala Phe Ser Thr Ala His Leu Glu Ser Ala Ala Pro His Leu Lys
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 Ser Pro Leu Ser Lys Gln Val Thr His Ala Leu Glu Gln Ser Leu His
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 Lys Ser Ile Pro Arg Val Glu Thr Arg Tyr Phe Ile Ser Ile Tyr Glu
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 Glu Glu Glu Gln Lys Asn Asp Val Leu Leu Gln Phe Ala Lys Leu Asp
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 Phe Asn Leu Leu Gln Met Leu His Lys Gln Glu Leu Ser Glu Val Ser
 245 250 255
 Arg Trp Trp Lys Asp Leu Asp Phe Val Thr Thr Leu Pro Tyr Ala Arg
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 Asp Arg Ala Val Glu Cys Tyr Phe Trp Thr Met Gly Val Tyr Ala Glu
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 Pro Gln Tyr Ser Gln Ala Arg Val Met Leu Ala Lys Thr Ile Ala Met

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					325					330						
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				340					345							
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	Val	Val	His	Tyr	Ala	Lys	Glu	Arg	Met	Lys	Glu	Ile	Val	Arg	Asn	Tyr
			370					375					380			
	Phe	Val	Glu	Ala	Lys	Trp	Phe	Ile	Glu	Gly	Tyr	Met	Pro	Pro	Val	Ser
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	Glu	Tyr	Leu	Ser	Asn	Ala	Leu	Ala	Thr	Ser	Thr	Tyr	Tyr	Leu	Leu	Thr
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	Thr	Thr	Ser	Tyr	Leu	Gly	Met	Lys	Ser	Ala	Asn	Lys	Gln	Asp	Phe	Glu
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	Trp	Leu	Ala	Lys	Asn	Pro	Lys	Ile	Leu	Glu	Ala	Asn	Val	Thr	Leu	Cys
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465						470					475					480
	Thr	Glu	Lys	Ala	Met	Glu	Lys	Phe	Gln	Glu	Met	Ala	Glu	Thr	Ala	Trp
				485						490						495
	Lys	Asp	Val	Asn	Glu	Gly	Ile	Leu	Arg	Pro	Thr	Pro	Val	Ser	Thr	Glu
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	Ile	Leu	Thr	Arg	Ile	Leu	Asn	Leu	Ala	Arg	Ile	Ile	Asp	Val	Thr	Tyr
			515				520						525			
	Lys	His	Asn	Gln	Asp	Gly	Tyr	Thr	His	Pro	Glu	Lys	Val	Leu	Lys	Pro
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	Met	Ala	Ser	Gln	Ala	Ser	Gln	Val	Leu	Ala	Ser	Pro
	1			5					10			

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His	Pro	Ala	Ile	Ser	Ser	Glu	Asn	Arg	Pro	Lys	Ala	Asp	Phe	His	Pro	
	15						20					25				

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Gly	Ile	Trp	Gly	Asp	Met	Phe	Ile	Ile	Cys	Pro	Asp	Thr			
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cattatacgt	acttgagcag	gat atc	gat gct	gca act	gaa tta	caa tat	gaa	1702				
		Asp	Ile	Asp	Ala	Ala	Thr	Glu	Leu	Gln	Tyr	Glu
			45						50			

gaa tta aaa gca- caa gtg agg aag atg att atg gaa cct gtt gat gat	1750
Glu Leu Lys 55 Ala Gln Val Arg Lys 60 Met Ile Met Glu Pro 65 Val Asp Asp	
tca aac caa aag ttg ccc ttc att gat gct gtt caa aga tta ggt gtg	1798
Ser Asn 70 Gln Lys Leu Pro Phe 75 Ile Asp Ala Val Gln Arg Leu Gly Val	
agt tat cat ttt gag aaa gag att gaa gat gaa cta gag aat att tac	1846
Ser Tyr His Phe Glu Lys 90 Glu Ile Glu Asp Glu Leu Glu Asn Ile Tyr 100	
cgt gac acc aac aac aat gat gcg gac acc gat ctc tac act aca gct	1894
Arg Asp Thr Asn 105 Asn Asn Asp Ala Asp 110 Thr Asp Leu Tyr Thr Thr Ala 115	
ctt cga ttc cgg tta ctt aga gag cat ggc ttc gat att tct tgt	1939
Leu Arg Phe Arg Leu Leu Arg Glu His 125 Gly Phe Asp Ile Ser Cys 130	
ggtaattaag tcttaaactt tcataactct tcttatccat ttatcaatta atattatcaa	1999
actttacatt aataatcatc tgtacaatac ttcaatatat atatatttat tgatgaaact	2059
aatgtttgat gatgattttg ggtgcttgac ca gat gca ttc aac aag ttc aaa	2112
Asp Ala Phe Asn Lys Phe Lys 135	
gat gag gca ggg aac ttc aag gca tca ttg aca agt gat gtg caa ggg	2160
Asp Glu Ala Gly Asn Phe Lys 145 Ala Ser Leu Thr Ser Asp Val Gln Gly 150	
ttg ttg gaa ctt tat gaa gct tcc tat atg agg gtc cat ggg gaa gat	2208
Leu Leu Glu Leu Tyr Glu Ala Ser Tyr Met Arg Val His Gly Glu Asp 170	
ata ctt gat gaa gcc att tct ttc acc act gct caa ctt aca ctt gct	2256
Ile Leu Asp Glu Ala 175 Ile Ser Phe Thr Thr Ala Gln Leu Thr Leu Ala 185	
cta cca act tta cac cat cct tta tcg gaa cag gtc ggc cat gcc tta	2304
Leu Pro Thr Leu His His Pro Leu Ser Glu Gln Val Gly His Ala Leu 200	
aag cag tct atc cga agg ggc ttg cca agg gtt gag gcc cgg aat ttc	2352
Lys Gln Ser Ile Arg Arg Gly Leu 210 Pro Arg Val Glu Ala Arg Asn Phe 215	
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Ile Ser Ile Tyr Gln Asp Leu Glu Ser His Asn Lys Ser Leu Leu Gln 220 225 230	
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Phe Ala Lys Ile Asp Phe Asn Leu Leu Gln Leu Leu His Arg Lys Glu	

235	240	245	250	
cta agt gag atc tgc agg taagtgtttg gagatcttta aagctatgaa				2496
Leu Ser Glu Ile Cys Arg				
255				
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gg tgg tgg aaa gat tta gac ttt aca aga aaa cta cca ttt gca aga				2603
Trp Trp Lys Asp Leu Asp Phe Thr Arg Lys Leu Pro Phe Ala Arg				
260	265	270		
gat aga gtg gtt gaa ggc tat ttt tgg ata atg gga gtt tac ttt gaa				2651
Asp Arg Val Val Glu Gly Tyr Phe Trp Ile Met Gly Val Tyr Phe Glu				
275	280	285		
ccc caa tac tct ctt ggt aga aag atg ttg aca aaa gtc ata gca atg				2699
Pro Gln Tyr Ser Leu Gly Arg Lys Met Leu Thr Lys Val Ile Ala Met				
290	295	300		
gct tcc att gtt gat gat act tat gat tca tat gca acc tat gat gaa				2747
Ala Ser Ile Val Asp Asp Thr Tyr Asp Ser Tyr Ala Thr Tyr Asp Glu				
305	310	315		
ctc att ccc tat aca aat gca att gaa ggtgagattt tttttccttt				2794
Leu Ile Pro Tyr Thr Asn Ala Ile Glu				
320	325			
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aaacgtagg atattcactc caacttgacag ttgctcatat tttaatgggtg atagtatgaa				2914
ctaaccaggc taagttag attcaaatta accctgaaat tgtgtttt agg tgg gat				2971
			Arg Trp Asp	
			330	
att aaa tgc atg aac caa ctc ccg aat tac atg aaa ata agc tac aag				3019
Ile Lys Cys Met Asn Gln Leu Pro Asn Tyr Met Lys Ile Ser Tyr Lys				
335	340	345		
gca cta tta gat gtt tat gaa gaa atg gaa cag ctg ttg gca aat caa				3067
Ala Leu Leu Asp Val Tyr Glu Glu Met Glu Gln Leu Leu Ala Asn Gln				
350	355	360		
ggg aga cag tac cga gtt gag tat gcg aaa aag gcg gtatgtaatg				3113
Gly Arg Gln Tyr Arg Val Glu Tyr Ala Lys Lys Ala				
365	370	375		
atacaatagt atgatatgct ttaatcataa acgtataaaa tttgaaaatt acattagcaa				3173
tttgcttact tttttatgcc tttaatcctc ag atg ata cgt ctt gtt caa gct				3226
	Met Ile Arg Leu Val Gln Ala			
	380			
tac ctt ttg gag gcc aaa tgg act cat caa aat tat aaa cca acc ttt				3274
Tyr Leu Leu Glu Ala Lys Trp Thr His Gln Asn Tyr Lys Pro Thr Phe				
385	390	395		

gag gaa ttt aga gat aat gca ttg cca acc tct ggc tat gcc atg ctt Glu Glu Phe Arg Asp Asn Ala Leu Pro Thr Ser Gly Tyr Ala Met Leu 400 405 410	3322
gct ata acg gcg ttt gtc ggc atg ggc gaa gtt ata acc cct gag acc Ala Ile Thr Ala Phe Val Gly Met Gly Glu Val Ile Thr Pro Glu Thr 415 420 425 430	3370
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att tgc agg ttc atg gac gat att gct gaa cat aag gtatactata Ile Cys Arg Phe Met Asp Asp Ile Ala Glu His Lys 450 455	3464
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ctt gct agg gtt atg gat gta ctt tac aga gaa ggt gac ggt tat aca Leu Ala Arg Val Met Asp Val Leu Tyr Arg Glu Gly Asp Gly Tyr Thr 520 525 530 535	3826
cat gtt ggg aaa gct gct aaa ggt ggg atc act tca tta ttg att gat His Val Gly Lys Ala Ala Lys Gly Gly Ile Thr Ser Leu Leu Ile Asp 540 545 550	3874
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<213> Gossypium arboreum	

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 Asp Met Phe Ile Ile Cys Pro Asp Thr
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 20 25 30
 Pro Phe Ile Asp Ala Val Gln Arg Leu Gly Val Ser Tyr His Phe Glu
 35 40 45
 Lys Glu Ile Glu Asp Glu Leu Glu Asn Ile Tyr Arg Asp Thr Asn Asn
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 35 40 45
 Thr Ala Gln Leu Thr Leu Ala Leu Pro Thr Leu His His Pro Leu Ser
 50 55 60
 Glu Gln Val Gly His Ala Leu Lys Gln Ser Ile Arg Arg Gly Leu Pro
 65 70 75 80
 Arg Val Glu Ala Arg Asn Phe Ile Ser Ile Tyr Gln Asp Leu Glu Ser
 85 90 95
 His Asn Lys Ser Leu Leu Gln Phe Ala Lys Ile Asp Phe Asn Leu Leu
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 Gln Leu Leu His Arg Lys Glu Leu Ser Glu Ile Cys Arg
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<210> 37
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<212> PRT

<213> Gossypium arboreum

<400> 37

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			20					25					30		
Gln	Tyr	Ser	Leu	Gly	Arg	Lys	Met	Leu	Thr	Lys	Val	Ile	Ala	Met	Ala
		35					40					45			
Ser	Ile	Val	Asp	Asp	Thr	Tyr	Asp	Ser	Tyr	Ala	Thr	Tyr	Asp	Glu	Leu
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Ile	Pro	Tyr	Thr	Asn	Ala	Ile	Glu								
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<210> 38

<211> 47

<212> PRT

<213> Gossypium arboreum

<400> 38

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			20					25					30		
Ala	Asn	Gln	Gly	Arg	Gln	Tyr	Arg	Val	Glu	Tyr	Ala	Lys	Lys	Ala	
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<210> 39

<211> 83

<212> PRT

<213> Gossypium arboreum

<400> 39

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Gln	Asn	Tyr	Lys	Pro	Thr	Phe	Glu	Glu	Phe	Arg	Asp	Asn	Ala	Leu	Pro
			20					25					30		
Thr	Ser	Gly	Tyr	Ala	Met	Leu	Ala	Ile	Thr	Ala	Phe	Val	Gly	Met	Gly
		35					40					45			
Glu	Val	Ile	Thr	Pro	Glu	Thr	Phe	Lys	Trp	Ala	Ala	Ser	Asp	Pro	Lys
	50					55					60				
Ile	Ile	Lys	Ala	Ser	Thr	Ile	Ile	Cys	Arg	Phe	Met	Asp	Asp	Ile	Ala
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Glu	His	Lys													

<210> 40

<211> 97

<212> PRT

<213> Gossypium arboreum

<400> 40

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			20					25					30			
His	Ile	Glu	Ser	Ser	Trp	Lys	Asp	Val	Asn	Glu	Glu	Phe	Leu	Lys	Pro	
		35					40					45				
Thr	Glu	Met	Pro	Thr	Pro	Val	Leu	Cys	Arg	Ser	Leu	Asn	Leu	Ala	Arg	
	50					55					60					
Val	Met	Asp	Val	Leu	Tyr	Arg	Glu	Gly	Asp	Gly	Tyr	Thr	His	Val	Gly	
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Lys	Ala	Ala	Lys	Gly	Gly	Ile	Thr	Ser	Leu	Leu	Ile	Asp	Pro	Ile	Gln	
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Ile																

<210> 41
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<220>
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 <223> casbene synthase

<400> 41

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	Met	Ala	Leu	Pro	Ser	Ala	Ala Met
	1		5		10		
ctt aac	tta ttt	cac aga	ttg tca	agc tta	ccc acc	act agc	ttg gaa
Leu Asn	Leu Phe	His Arg	Leu Ser	Ser Ser	Leu Pro	Thr Thr	Ser Leu
15		20			25		30
tat ggc	aat aat	cgc ttc	cct ttc	ttt tcc	tca tct	gcc aag	tca cac
Tyr Gly	Asn Asn	Arg Phe	Pro Phe	Phe Ser	Ser Ser	Ala Lys	Ser His
		35		40		45	
ttt aaa	aaa cca	act caa	gca tgt	tta tcc	tca aca	acc cac	caa gaa
Phe Lys	Lys Pro	Thr Gln	Ala Cys	Leu Ser	Ser Ser	Thr Thr	His Gln
	50		55			60	
gtt cgt	cca tta	gca tac	ttt cct	cct act	gtc tgg	ggc aat	cgc ttt
Val Arg	Pro Leu	Ala Tyr	Phe Pro	Pro Thr	Val Trp	Gly Asn	Arg Phe
	65		70		75		
gct tcc	ttg acc	ttc aat	cca tcg	gaa ttt	gaa tcg	tat gat	gaa cgg
Ala Ser	Leu Thr	Phe Asn	Pro Ser	Glu Phe	Glu Ser	Tyr Asp	Glu Arg
	80		85		90		
gta att	gtg ctg	aag aaa	aaa gtt	aag gac	ata tta	att tca	tct aca
Val Ile	Val Leu	Lys Lys	Lys Val	Lys Asp	Ile Leu	Ile Ser	Ser Thr

95	100					105					110					
agt gat tca gtg gag acc gtt att tta atc gac tta tta tgt cgg ctt Ser Asp Ser Val Glu Thr Val Ile Leu Ile Asp Leu Leu Cys Arg Leu	115					120					125					444
ggc gta tca tat cac ttt gaa aat gat att gaa gag cta cta agt aaa Gly Val Ser Tyr His Phe Glu Asn Asp Ile Glu Glu Leu Leu Ser Lys	130					135					140					492
atc ttc aac tcc cag cct gac ctt gtc gat gaa aaa gaa tgt gat ctc Ile Phe Asn Ser Gln Pro Asp Leu Val Asp Glu Lys Glu Cys Asp Leu	145					150					155					540
tac act gcg gca att gta ttc cga gtt ttc aga cag cat ggt ttt aaa Tyr Thr Ala Ala Ile Val Phe Arg Val Phe Arg Gln His Gly Phe Lys	160					165					170					588
atg tct tcg gat gtg ttt agc aaa ttc aag gac agt gat ggt aag ttc Met Ser Ser Asp Val Phe Ser Lys Phe Lys Asp Ser Asp Gly Lys Phe	175					180					185					636
aag gaa tcc cta cgg ggt gat gct aag ggt atg ctc agc ctt ttt gaa Lys Glu Ser Leu Arg Gly Asp Ala Lys Gly Met Leu Ser Leu Phe Glu	195					200					205					684
gct tcc cat cta agt gtg cat gga gaa gac att ctt gaa gaa gcc ttt Ala Ser His Leu Ser Val His Gly Glu Asp Ile Leu Glu Glu Ala Phe	210					215					220					732
gct ttc acc aag gat tac tta cag tcc tct gca gtt gag tta ttc cct Ala Phe Thr Lys Asp Tyr Leu Gln Ser Ser Ala Val Glu Leu Phe Pro	225					230					235					780
aat ctc aaa agg cat ata acg aac gcc cta gag cag cct ttc cac agt Asn Leu Lys Arg His Ile Thr Asn Ala Leu Glu Gln Pro Phe His Ser	240					245					250					828
ggc gtg ccg agg cta gag gcc agg aaa ttc atc gat cta tac gaa gct Gly Val Pro Arg Leu Glu Ala Arg Lys Phe Ile Asp Leu Tyr Glu Ala	255					260					265					876
gat att gaa tgc cgg aat gaa act ctg ctc gag ttt gca aag ttg gat Asp Ile Glu Cys Arg Asn Glu Thr Leu Leu Glu Phe Ala Lys Leu Asp	275					280					285					924
tat aat aga gtt cag tta ttg cac caa caa gag ctg tgc cag ttc tca Tyr Asn Arg Val Gln Leu Leu His Gln Gln Glu Leu Cys Gln Phe Ser	290					295					300					972
aag tgg tgg aaa gac ctg aat ctt gct tcg gat att cct tat gca aga Lys Trp Trp Lys Asp Leu Asn Leu Ala Ser Asp Ile Pro Tyr Ala Arg	305					310					315					1020

gac Asp 320	aga Arg 320	atg Met 320	gca Ala 320	gag Glu 320	att Ile 325	ttc Phe 325	ttt Phe 325	tgg Trp 325	gca Ala 330	gtc Val 330	gcg Ala 330	atg Met 330	tac Tyr 330	ttt Phe 330	gag Glu 330	1068
cct Pro 335	gac Asp 335	tat Tyr 335	gca Ala 340	cac His 340	acc Thr 340	cga Arg 340	atg Met 340	att Ile 345	att Ile 345	gcg Ala 345	aag Lys 345	gtt Val 350	gta Val 350	ttg Leu 350	ctt Leu 350	1116
ata Ile 355	tca Ser 355	cta Leu 355	ata Ile 355	gat Asp 355	gat Asp 355	aca Thr 360	att Ile 360	gat Asp 360	gcg Ala 360	tat Tyr 360	gca Ala 365	aca Thr 365	atg Met 365	gag Glu 365	gaa Glu 365	1164
act Thr 370	cat His 370	att Ile 370	ctt Leu 370	gct Ala 375	gaa Glu 375	gca Ala 375	gtc Val 375	gca Ala 375	agg Arg 375	tgg Trp 380	gac Asp 380	atg Met 380	agc Ser 380	tgc Cys 380	ctc Leu 380	1212
gag Glu 385	aag Lys 385	ctg Leu 385	cca Pro 390	gat Asp 390	tac Tyr 390	atg Met 390	aaa Lys 390	gtt Val 395	att Ile 395	tat Tyr 395	aaa Lys 395	cta Leu 395	ttg Leu 395	cta Leu 395	aac Asn 395	1260
acc Thr 400	ttc Phe 400	tct Ser 405	gaa Glu 405	ttc Phe 405	gag Glu 405	aaa Lys 405	gaa Glu 410	ttg Leu 410	acg Thr 410	gcg Ala 410	gaa Glu 410	ggc Gly 410	aag Lys 410	tcc Ser 410	tac Tyr 410	1308
agc Ser 415	gtc Val 415	aaa Lys 420	tac Tyr 420	gga Gly 420	agg Arg 420	gaa Glu 425	gcg Ala 425	ttt Phe 425	caa Gln 425	gaa Glu 425	cta Leu 425	gtg Val 430	aga Arg 430	ggg Gly 430	tac Tyr 430	1356
tac Tyr 435	ctg Leu 435	gag Glu 435	gct Ala 435	gta Val 435	tgg Trp 440	cgc Arg 440	gac Asp 440	gag Glu 440	ggg Gly 440	aaa Lys 445	ata Ile 445	cca Pro 445	tcg Ser 445	ttc Phe 445	gat Asp 445	1404
gac Asp 450	tac Tyr 450	ttg Leu 450	tat Tyr 450	aat Asn 455	gga Gly 455	tcc Ser 455	atg Met 455	acc Thr 455	acc Thr 455	gga Gly 460	ttg Leu 460	cct Pro 460	ctc Leu 460	gtc Val 460	tca Ser 460	1452
aca Thr 465	gct Ala 465	tct Ser 465	ttc Phe 470	atg Met 470	gga Gly 470	gtt Val 470	caa Gln 470	gaa Glu 475	att Ile 475	aca Thr 475	ggg Gly 475	ctc Leu 475	aac Asn 475	gaa Glu 475	ttc Phe 475	1500
caa Gln 480	tgg Trp 480	ctg Leu 485	gaa Glu 485	act Thr 485	aat Asn 485	ccc Pro 485	aaa Lys 485	tta Leu 490	agt Ser 490	tat Tyr 490	gct Ala 490	tcc Ser 490	ggg Gly 490	gca Ala 490	ttc Phe 490	1548
atc Ile 495	cga Arg 500	ctt Leu 500	gtc Val 500	aac Asn 500	gac Asp 500	tta Leu 505	act Thr 505	tct Ser 505	cat His 505	gtg Val 505	act Thr 505	gaa Glu 510	caa Gln 510	caa Gln 510	aga Arg 510	1596
gga Gly 515	cac His 515	gtt Val 515	gca Ala 515	tct Ser 515	tgc Cys 520	atc Ile 520	gac Asp 520	tgc Cys 520	tat Tyr 520	atg Met 525	aac Asn 525	caa Gln 525	cat His 525	gga Gly 525	gtt Val 525	1644

tcc	aaa	gac	gaa	gca	gtc	aaa	ata	ctt	caa	aaa	atg	gct	aca	gat	tgt	1692
Ser	Lys	Asp	Glu	Ala	Val	Lys	Ile	Leu	Gln	Lys	Met	Ala	Thr	Asp	Cys	
			530					535					540			
tgg	aaa	gaa	att	aat	gaa	gaa	tgt	atg	agg	cag	agt	caa	gtg	tca	gtg	1740
Trp	Lys	Glu	Ile	Asn	Glu	Glu	Cys	Met	Arg	Gln	Ser	Gln	Val	Ser	Val	
		545					550					555				
ggt	cac	cta	atg	aga	ata	gtt	aat	ctg	gca	cgt	ctt	acg	gat	gtg	agt	1788
Gly	His	Leu	Met	Arg	Ile	Val	Asn	Leu	Ala	Arg	Leu	Thr	Asp	Val	Ser	
		560				565					570					
tac	aag	tat	gga	gac	ggt	tac	act	gat	tcc	cag	caa	ttg	aaa	caa	ttt	1836
Tyr	Lys	Tyr	Gly	Asp	Gly	Tyr	Thr	Asp	Ser	Gln	Gln	Leu	Lys	Gln	Phe	
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ggt	aag	gga	ttg	ttc	gtt	gat	cca	att	tct	att	tgaactcaat	aattcctttt				1889
Val	Lys	Gly	Leu	Phe	Val	Asp	Pro	Ile	Ser	Ile						
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<210> 42
 <211> 601
 <212> PRT
 <213> Ricinus communis

<400> 42

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Asn	Asn	Arg	Phe	Pro	Phe	Phe	Ser	Ser	Ser	Ala	Lys	Ser	His	Phe	Lys	
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Lys	Pro	Thr	Gln	Ala	Cys	Leu	Ser	Ser	Thr	Thr	His	Gln	Glu	Val	Arg	
	50					55					60					
Pro	Leu	Ala	Tyr	Phe	Pro	Pro	Thr	Val	Trp	Gly	Asn	Arg	Phe	Ala	Ser	
65				70						75					80	
Leu	Thr	Phe	Asn	Pro	Ser	Glu	Phe	Glu	Ser	Tyr	Asp	Glu	Arg	Val	Ile	
			85						90					95		
Val	Leu	Lys	Lys	Lys	Val	Lys	Asp	Ile	Leu	Ile	Ser	Ser	Thr	Ser	Asp	
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Ser	Val	Glu	Thr	Val	Ile	Leu	Ile	Asp	Leu	Leu	Cys	Arg	Leu	Gly	Val	
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Ser	Tyr	His	Phe	Glu	Asn	Asp	Ile	Glu	Glu	Leu	Leu	Ser	Lys	Ile	Phe	
	130					135						140				
Asn	Ser	Gln	Pro	Asp	Leu	Val	Asp	Glu	Lys	Glu	Cys	Asp	Leu	Tyr	Thr	
145					150					155					160	
Ala	Ala	Ile	Val	Phe	Arg	Val	Phe	Arg	Gln	His	Gly	Phe	Lys	Met	Ser	
			165					170						175		
Ser	Asp	Val	Phe	Ser	Lys	Phe	Lys	Asp	Ser	Asp	Gly	Lys	Phe	Lys	Glu	
			180					185					190			

Ser	Leu	Arg	Gly	Asp	Ala	Lys	Gly	Met	Leu	Ser	Leu	Phe	Glu	Ala	Ser
		195					200					205			
His	Leu	Ser	Val	His	Gly	Glu	Asp	Ile	Leu	Glu	Glu	Ala	Phe	Ala	Phe
	210					215					220				
Thr	Lys	Asp	Tyr	Leu	Gln	Ser	Ser	Ala	Val	Glu	Leu	Phe	Pro	Asn	Leu
225					230					235					240
Lys	Arg	His	Ile	Thr	Asn	Ala	Leu	Glu	Gln	Pro	Phe	His	Ser	Gly	Val
				245					250					255	
Pro	Arg	Leu	Glu	Ala	Arg	Lys	Phe	Ile	Asp	Leu	Tyr	Glu	Ala	Asp	Ile
			260					265						270	
Glu	Cys	Arg	Asn	Glu	Thr	Leu	Leu	Glu	Phe	Ala	Lys	Leu	Asp	Tyr	Asn
		275					280								
Arg	Val	Gln	Leu	Leu	His	Gln	Gln	Glu	Leu	Cys	Gln	Phe	Ser	Lys	Trp
	290					295					300				
Trp	Lys	Asp	Leu	Asn	Leu	Ala	Ser	Asp	Ile	Pro	Tyr	Ala	Arg	Asp	Arg
305					310					315					320
Met	Ala	Glu	Ile	Phe	Phe	Trp	Ala	Val	Ala	Met	Tyr	Phe	Glu	Pro	Asp
				325					330					335	
Tyr	Ala	His	Thr	Arg	Met	Ile	Ile	Ala	Lys	Val	Val	Leu	Leu	Ile	Ser
			340					345						350	
Leu	Ile	Asp	Asp	Thr	Ile	Asp	Ala	Tyr	Ala	Thr	Met	Glu	Glu	Thr	His
		355					360					365			
Ile	Leu	Ala	Glu	Ala	Val	Ala	Arg	Trp	Asp	Met	Ser	Cys	Leu	Glu	Lys
	370					375						380			
Leu	Pro	Asp	Tyr	Met	Lys	Val	Ile	Tyr	Lys	Leu	Leu	Leu	Asn	Thr	Phe
385					390					395					400
Ser	Glu	Phe	Glu	Lys	Glu	Leu	Thr	Ala	Glu	Gly	Lys	Ser	Tyr	Ser	Val
				405					410					415	
Lys	Tyr	Gly	Arg	Glu	Ala	Phe	Gln	Glu	Leu	Val	Arg	Gly	Tyr	Tyr	Leu
			420					425					430		
Glu	Ala	Val	Trp	Arg	Asp	Glu	Gly	Lys	Ile	Pro	Ser	Phe	Asp	Asp	Tyr
		435					440					445			
Leu	Tyr	Asn	Gly	Ser	Met	Thr	Thr	Gly	Leu	Pro	Leu	Val	Ser	Thr	Ala
	450					455					460				
Ser	Phe	Met	Gly	Val	Gln	Glu	Ile	Thr	Gly	Leu	Asn	Glu	Phe	Gln	Trp
465					470					475					480
Leu	Glu	Thr	Asn	Pro	Lys	Leu	Ser	Tyr	Ala	Ser	Gly	Ala	Phe	Ile	Arg
				485					490					495	
Leu	Val	Asn	Asp	Leu	Thr	Ser	His	Val	Thr	Glu	Gln	Gln	Arg	Gly	His
			500					505					510		
Val	Ala	Ser	Cys	Ile	Asp	Cys	Tyr	Met	Asn	Gln	His	Gly	Val	Ser	Lys
		515					520					525			
Asp	Glu	Ala	Val	Lys	Ile	Leu	Gln	Lys	Met	Ala	Thr	Asp	Cys	Trp	Lys
	530					535					540				
Glu	Ile	Asn	Glu	Glu	Cys	Met	Arg	Gln	Ser	Gln	Val	Ser	Val	Gly	His
545					550					555					560
Leu	Met	Arg	Ile	Val	Asn	Leu	Ala	Arg	Leu	Thr	Asp	Val	Ser	Tyr	Lys
				565					570					575	
Tyr	Gly	Asp	Gly	Tyr	Thr	Asp	Ser	Gln	Gln	Leu	Lys	Gln	Phe	Val	Lys
			580					585					590		
Gly	Leu	Phe	Val	Asp	Pro	Ile	Ser	Ile							
		595					600								

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 <212> DNA
 <213> Taxus brevifolia

<220>
 <221> CDS
 <222> (22)...(2610)
 <223> taxadiene synthase

<400> 43

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	1 5 10	
aag atg aac gca ttg ggg aac aag gca atc cac gat cca acg aat tgc		99
Lys Met Asn Ala Leu Gly Asn Lys Ala Ile His Asp Pro Thr Asn Cys		
	15 20 25	
aga gcc aaa tct gag cgc caa atg atg tgg gtt tgc tcc aga tca ggg		147
Arg Ala Lys Ser Glu Arg Gln Met Met Trp Val Cys Ser Arg Ser Gly		
	30 35 40	
cga acc aga gta aaa atg tcg aga gga agt ggt ggt cct ggt cct gtc		195
Arg Thr Arg Val Lys Met Ser Arg Gly Ser Gly Gly Pro Gly Pro Val		
	45 50 55	
gta atg atg agc agc agc act ggc act agc aag gtg gtt tcc gag act		243
Val Met Met Ser Ser Ser Thr Gly Thr Ser Lys Val Val Ser Glu Thr		
	60 65 70	
tcc agt acc att gtg gat gat atc cct cga ctc tcc gcc aat tat cat		291
Ser Ser Thr Ile Val Asp Asp Ile Pro Arg Leu Ser Ala Asn Tyr His		
	75 80 85 90	
ggc gat ctg tgg cac cac aat gtt ata caa act ctg gag aca ccg ttt		339
Gly Asp Leu Trp His His Asn Val Ile Gln Thr Leu Glu Thr Pro Phe		
	95 100 105	
cgt gag agt tct act tac caa gaa cgg gca gat gag ctg gtt gtg aaa		387
Arg Glu Ser Ser Thr Tyr Gln Glu Arg Ala Asp Glu Leu Val Val Lys		
	110 115 120	
att aaa gat atg ttc aat gcg ctc gga gac gga gat atc agt ccg tct		435
Ile Lys Asp Met Phe Asn Ala Leu Gly Asp Gly Asp Ile Ser Pro Ser		
	125 130 135	
gca tac gac act gcg tgg gtg gcg agg ctg gcg acc att tcc tct gat		483
Ala Tyr Asp Thr Ala Trp Val Ala Arg Leu Ala Thr Ile Ser Ser Asp		
	140 145 150	
gga tct gag aag cca cgg ttt cct cag gcc ctc aac tgg gtt ttc aac		531
Gly Ser Glu Lys Pro Arg Phe Pro Gln Ala Leu Asn Trp Val Phe Asn		

155					160					165					170	
aac	cag	ctc	cag	gat	gga	tcg	tgg	ggt	atc	gaa	tcg	cac	ttt	agt	tta	579
Asn	Gln	Leu	Gln	Asp	Gly	Ser	Trp	Gly	Ile	Glu	Ser	His	Phe	Ser	Leu	
				175					180					185		
tgc	gat	cga	ttg	ctt	aac	acg	acc	aat	tct	gtt	atc	gcc	ctc	tcg	gtt	627
Cys	Asp	Arg	Leu	Leu	Asn	Thr	Thr	Asn	Ser	Val	Ile	Ala	Leu	Ser	Val	
			190					195					200			
tgg	aaa	aca	ggg	cac	agc	caa	gta	caa	caa	ggt	gct	gag	ttt	att	gca	675
Trp	Lys	Thr	Gly	His	Ser	Gln	Val	Gln	Gln	Gly	Ala	Glu	Phe	Ile	Ala	
			205				210					215				
gag	aat	cta	aga	tta	ctc	aat	gag	gaa	gat	gag	ttg	tcc	ccg	gat	ttc	723
Glu	Asn	Leu	Arg	Leu	Leu	Asn	Glu	Glu	Asp	Glu	Leu	Ser	Pro	Asp	Phe	
	220					225					230					
caa	ata	atc	ttt	cct	gct	ctg	ctg	caa	aag	gca	aaa	gcg	ttg	ggg	atc	771
Gln	Ile	Ile	Phe	Pro	Ala	Leu	Leu	Gln	Lys	Ala	Lys	Ala	Leu	Gly	Ile	
	235				240					245					250	
aat	ctt	cct	tac	gat	ctt	cca	ttt	atc	aaa	tat	ttg	tcg	aca	aca	cgg	819
Asn	Leu	Pro	Tyr	Asp	Leu	Pro	Phe	Ile	Lys	Tyr	Leu	Ser	Thr	Thr	Arg	
				255					260					265		
gaa	gcc	agg	ctt	aca	gat	gtt	tct	gcg	gca	gca	gac	aat	att	cca	gcc	867
Glu	Ala	Arg	Leu	Thr	Asp	Val	Ser	Ala	Ala	Ala	Asp	Asn	Ile	Pro	Ala	
			270					275					280			
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Asn	Met	Leu	Asn	Ala	Leu	Glu	Gly	Leu	Glu	Glu	Val	Ile	Asp	Trp	Asn	
		285				290						295				
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Lys	Ile	Met	Arg	Phe	Gln	Ser	Lys	Asp	Gly	Ser	Phe	Leu	Ser	Ser	Pro	
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gcc	tcc	act	gcc	tgt	gta	ctg	atg	aat	aca	ggg	gac	gaa	aaa	tgt	ttc	1011
Ala	Ser	Thr	Ala	Cys	Val	Leu	Met	Asn	Thr	Gly	Asp	Glu	Lys	Cys	Phe	
	315				320					325					330	
act	ttt	ctc	aac	aat	ctg	ctc	gac	aaa	ttc	ggc	ggc	tgc	gtg	ccc	tgt	1059
Thr	Phe	Leu	Asn	Asn	Leu	Leu	Asp	Lys	Phe	Gly	Gly	Cys	Val	Pro	Cys	
				335					340					345		
atg	tat	tcc	atc	gat	ctg	ctg	gaa	cgc	ctt	tcg	ctg	gtt	gat	aac	att	1107
Met	Tyr	Ser	Ile	Asp	Leu	Leu	Glu	Arg	Leu	Ser	Leu	Val	Asp	Asn	Ile	
				350				355					360			
gag	cat	ctc	gga	atc	ggt	cgc	cat	ttc	aaa	caa	gaa	atc	aaa	gga	gct	1155
Glu	His	Leu	Gly	Ile	Gly	Arg	His	Phe	Lys	Gln	Glu	Ile	Lys	Gly	Ala	
		365					370					375				

ctt	gat	tat	gtc	tac	aga	cat	tgg	agt	gaa	agg	ggc	atc	ggg	tgg	ggc	1203
Leu	Asp	Tyr	Val	Tyr	Arg	His	Trp	Ser	Glu	Arg	Gly	Ile	Gly	Trp	Gly	
380						385					390					
aga	gac	agc	ctt	gtt	cca	gat	ctc	aac	acc	aca	gcc	ctc	ggc	ctg	cga	1251
Arg	Asp	Ser	Leu	Val	Pro	Asp	Leu	Asn	Thr	Thr	Ala	Leu	Gly	Leu	Arg	
395					400					405					410	
act	ctt	cgc	atg	cac	gga	tac	aat	gtt	tct	tca	gac	gtt	ttg	aat	aat	1299
Thr	Leu	Arg	Met	His	Gly	Tyr	Asn	Val	Ser	Ser	Asp	Val	Leu	Asn	Asn	
				415					420					425		
ttc	aaa	gat	gaa	aac	ggg	cgg	ttc	ttc	tcc	tct	gcg	ggc	caa	acc	cat	1347
Phe	Lys	Asp	Glu	Asn	Gly	Arg	Phe	Phe	Ser	Ser	Ala	Gly	Gln	Thr	His	
			430					435					440			
gtc	gaa	ttg	aga	agc	gtg	gtg	aat	ctt	ttc	aga	gct	tcc	gac	ctt	gca	1395
Val	Glu	Leu	Arg	Ser	Val	Val	Asn	Leu	Phe	Arg	Ala	Ser	Asp	Leu	Ala	
		445					450					455				
ttt	cct	gac	gaa	aga	gct	atg	gac	gat	gct	aga	aaa	ttt	gca	gaa	cca	1443
Phe	Pro	Asp	Glu	Arg	Ala	Met	Asp	Asp	Ala	Arg	Lys	Phe	Ala	Glu	Pro	
	460					465					470					
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Tyr	Leu	Arg	Glu	Ala	Leu	Ala	Thr	Lys	Ile	Ser	Thr	Asn	Thr	Lys	Leu	
475					480					485					490	
ttc	aaa	gag	att	gag	tac	gtg	gtg	gag	tac	cct	tgg	cac	atg	agt	atc	1539
Phe	Lys	Glu	Ile	Glu	Tyr	Val	Val	Glu	Tyr	Pro	Trp	His	Met	Ser	Ile	
				495					500					505		
cca	cgc	tta	gaa	gcc	aga	agt	tat	att	gat	tca	tat	gac	gac	aat	tat	1587
Pro	Arg	Leu	Glu	Ala	Arg	Ser	Tyr	Ile	Asp	Ser	Tyr	Asp	Asp	Asn	Tyr	
			510					515					520			
gta	tgg	cag	agg	aag	act	cta	tat	aga	atg	cca	tct	ttg	agt	aat	tca	1635
Val	Trp	Gln	Arg	Lys	Thr	Leu	Tyr	Arg	Met	Pro	Ser	Leu	Ser	Asn	Ser	
		525					530					535				
aaa	tgt	tta	gaa	ttg	gca	aaa	ttg	gac	ttc	aat	atc	gta	caa	tct	ttg	1683
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Tyr Ile Pro Thr Phe Glu Glu Tyr Leu Lys Thr Tyr Ala Ile Ser Val	
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Gly Leu Gly Pro Cys Thr Leu Gln Pro Ile Leu Leu Met Gly Glu Leu	
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Val Lys Asp Asp Val Val Glu Lys Val His Tyr Pro Ser Asn Met Phe	
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Gln Ala Glu Lys Ala Arg Gly Gln Gln Ala Ser Gly Ile Ala Cys Tyr	
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Met Lys Asp Asn Pro Gly Ala Thr Glu Glu Asp Ala Ile Lys His Ile	
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Cys 795	Arg	Val	Val	Asp	Arg 800	Ala	Leu	Lys	Glu	Ala 805	Ser	Phe	Glu	Tyr	Phe 810	
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ctt Leu	aga Arg	ttg Leu	tgt Cys 830	gtc Val	caa Gln	atc Ile	ttt Phe	tac Tyr 835	aag Lys	ttt Phe	ata Ile	gat Asp	ggg Gly 840	tac Tyr	gga Gly	2547
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Tyr	Arg	Glu	Arg	Ala	Glu	Val	Leu	Val	Ser	Glu	Ile	Lys	Val	Met	Leu		
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Gly	Asp	Leu	Gln	Val	Glu	Gln	Gly	Ile	Glu	Phe	Ile	Lys	Ser	Asn	Leu	
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Glu	Leu	Val	Lys	Asp	Glu	Thr	Asp	Gln	Asp	Ser	Leu	Val	Thr	Asp	Phe	
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Val	Tyr	Arg	Pro	Asp	Tyr	Ala	Arg	Ile	Ala	Lys	Cys	Val	Tyr	Lys	Leu	
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Pro	Tyr	Val	Asn	Asn	Glu	Lys	Phe	Leu	Glu	Leu	Gly	Lys	Leu	Asp	Phe	
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Pro	Leu	Glu	Phe	Tyr	Phe	Leu	Val	Ala	Ala	Gly	Thr	Tyr	Glu	Pro	Gln	
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His	Glu	Val	Ala	Trp	Glu	Ala	Glu	Lys	Glu	Gln	Gly	Arg	Glu	Leu	Val	
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agc	ttt	ttc	aga	aag	gga	tgg	gag	gat	tat	ctt	ctg	ggt	tat	tat	gaa	1825
Ser	Phe	Phe	Arg	Lys	Gly	Trp	Glu	Asp	Tyr	Leu	Leu	Gly	Tyr	Tyr	Glu	
				595					600					605		
gaa	gct	gaa	tgg	tta	gct	gct	gag	tat	gtg	cct	acc	ttg	gac	gag	tac	1873
Glu	Ala	Glu	Trp	Leu	Ala	Ala	Glu	Tyr	Val	Pro	Thr	Leu	Asp	Glu	Tyr	
				610					615					620		
ata	aag	aat	gga	atc	aca	tct	atc	ggc	caa	cgt	ata	ctt	ctg	ttg	agt	1921
Ile	Lys	Asn	Gly	Ile	Thr	Ser	Ile	Gly	Gln	Arg	Ile	Leu	Leu	Leu	Ser	
				625					630					635		
gga	gtg	ttg	ata	atg	gat	ggg	caa	ctc	ctt	tcg	caa	gag	gca	tta	gag	1969
Gly	Val	Leu	Ile	Met	Asp	Gly	Gln	Leu	Leu	Ser	Gln	Glu	Ala	Leu	Glu	
				645					650					655		
aaa	gta	gat	tat	cca	gga	aga	cgt	gtt	ctc	aca	gag	ctg	aat	agc	ctc	2017
Lys	Val	Asp	Tyr	Pro	Gly	Arg	Arg	Val	Leu	Thr	Glu	Leu	Asn	Ser	Leu	
				660					665					670		
att	tcc	cgc	ctg	gcg	gat	gac	acg	aag	aca	tat	aaa	gct	gag	aag	gct	2065
Ile	Ser	Arg	Leu	Ala	Asp	Asp	Thr	Lys	Thr	Tyr	Lys	Ala	Glu	Lys	Ala	
				675					680					685		

cgt gga gaa ttg gcg tcc agc att gaa tgt tac atg aaa gac cat cct	2113
Arg Gly Glu Leu Ala Ser Ser Ile Glu Cys Tyr Met Lys Asp His Pro	
690 695 700	
gaa tgt aca gag gaa gag gct ctc gat cac atc tat agc att ctg gag	2161
Glu Cys Thr Glu Glu Glu Ala Leu Asp His Ile Tyr Ser Ile Leu Glu	
705 710 715 720	
ccg gcg gtg aag gaa ctg aca aga gag ttt ctg aag ccc gac gac gtc	2209
Pro Ala Val Lys Glu Leu Thr Arg Glu Phe Leu Lys Pro Asp Asp Val	
725 730 735	
cca ttc gcc tgc aag aag atg ctt ttc gag gag aca aga gtg acg atg	2257
Pro Phe Ala Cys Lys Lys Met Leu Phe Glu Glu Thr Arg Val Thr Met	
740 745 750	
gtg ata ttc aag gat gga gat gga ttc ggt gtt tcc aaa tta gaa gtc	2305
Val Ile Phe Lys Asp Gly Asp Gly Phe Gly Val Ser Lys Leu Glu Val	
755 760 765	
aaa gat cat atc aaa gag tgt ctc att gaa ccg ctg cca ctg taa	2350
Lys Asp His Ile Lys Glu Cys Leu Ile Glu Pro Leu Pro Leu *	
770 775 780	
tcaaaatagt tgcaataata attgaaataa tgtcaactat gtttcacaaa aaaaaaaaaa	2410
aaaaaaaaaa aaaa	2424

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 <212> PRT
 <213> *Abies grandis*

<400> 46

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Tyr Arg Glu Arg Ala Glu Val Leu Val Ser Glu Ile Lys Val Met Leu	
20 25 30	
Asn Pro Ala Ile Thr Gly Asp Gly Glu Ser Met Ile Thr Pro Ser Ala	
35 40 45	
Tyr Asp Thr Ala Trp Val Ala Arg Val Pro Ala Ile Asp Gly Ser Ala	
50 55 60	
Arg Pro Gln Phe Pro Gln Thr Val Asp Trp Ile Leu Lys Asn Gln Leu	
65 70 75 80	
Lys Asp Gly Ser Trp Gly Ile Gln Ser His Phe Leu Leu Ser Asp Arg	
85 90 95	
Leu Leu Ala Thr Leu Ser Cys Val Leu Val Leu Leu Lys Trp Asn Val	
100 105 110	
Gly Asp Leu Gln Val Glu Gln Gly Ile Glu Phe Ile Lys Ser Asn Leu	
115 120 125	
Glu Leu Val Lys Asp Glu Thr Asp Gln Asp Ser Leu Val Thr Asp Phe	
130 135 140	
Glu Ile Ile Phe Pro Ser Leu Leu Arg Glu Ala Gln Ser Leu Arg Leu	

145	Gly	Leu	Pro	Tyr	Asp	150	Leu	Pro	Tyr	Ile	His	155	Leu	Leu	Gln	Thr	Lys	160	Arg
					165						170						175		
	Gln	Glu	Arg	Leu	Ala	Lys	Leu	Ser	Arg	Glu	Glu	Ile	Tyr	Ala	Val	Pro			
				180					185						190				
	Ser	Pro	Leu	Leu	Tyr	Ser	Leu	Glu	Gly	Ile	Gln	Asp	Ile	Val	Glu	Trp			
			195					200						205					
	Glu	Arg	Ile	Met	Glu	Val	Gln	Ser	Gln	Asp	Gly	Ser	Phe	Leu	Ser	Ser			
		210					215					220							
	Pro	Ala	Ser	Thr	Ala	Cys	Val	Phe	Met	His	Thr	Gly	Asp	Ala	Lys	Cys			
225					230						235					240			
	Leu	Glu	Phe	Leu	Asn	Ser	Val	Met	Ile	Lys	Phe	Gly	Asn	Phe	Val	Pro			
				245						250					255				
	Cys	Leu	Tyr	Pro	Val	Asp	Leu	Leu	Glu	Arg	Leu	Leu	Ile	Val	Asp	Asn			
			260						265					270					
	Ile	Val	Arg	Leu	Gly	Ile	Tyr	Arg	His	Phe	Glu	Lys	Glu	Ile	Lys	Glu			
		275						280					285						
	Ala	Leu	Asp	Tyr	Val	Tyr	Arg	His	Trp	Asn	Glu	Arg	Gly	Ile	Gly	Trp			
		290					295					300							
	Gly	Arg	Leu	Asn	Pro	Ile	Ala	Asp	Leu	Glu	Thr	Thr	Ala	Leu	Gly	Phe			
305					310						315					320			
	Arg	Leu	Leu	Arg	Leu	His	Arg	Tyr	Asn	Val	Ser	Pro	Ala	Ile	Phe	Asp			
				325					330						335				
	Asn	Phe	Lys	Asp	Ala	Asn	Gly	Lys	Phe	Ile	Cys	Ser	Thr	Gly	Gln	Phe			
			340						345					350					
	Asn	Lys	Asp	Val	Ala	Ser	Met	Leu	Asn	Leu	Tyr	Arg	Ala	Ser	Gln	Leu			
		355						360					365						
	Ala	Phe	Pro	Gly	Glu	Asn	Ile	Leu	Asp	Glu	Ala	Lys	Ser	Phe	Ala	Thr			
		370				375						380							
	Lys	Tyr	Leu	Arg	Glu	Ala	Leu	Glu	Lys	Ser	Glu	Thr	Ser	Ser	Ala	Trp			
385					390						395					400			
	Asn	Asn	Lys	Gln	Asn	Leu	Ser	Gln	Glu	Ile	Lys	Tyr	Ala	Leu	Lys	Thr			
				405					410						415				
	Ser	Trp	His	Ala	Ser	Val	Pro	Arg	Val	Glu	Ala	Lys	Arg	Tyr	Cys	Gln			
			420						425					430					
	Val	Tyr	Arg	Pro	Asp	Tyr	Ala	Arg	Ile	Ala	Lys	Cys	Val	Tyr	Lys	Leu			
		435						440					445						
	Pro	Tyr	Val	Asn	Asn	Glu	Lys	Phe	Leu	Glu	Leu	Gly	Lys	Leu	Asp	Phe			
		450				455						460							
	Asn	Ile	Ile	Gln	Ser	Ile	His	Gln	Glu	Glu	Met	Lys	Asn	Val	Thr	Ser			
465					470						475					480			
	Trp	Phe	Arg	Asp	Ser	Gly	Leu	Pro	Leu	Phe	Thr	Phe	Ala	Arg	Glu	Arg			
				485					490						495				
	Pro	Leu	Glu	Phe	Tyr	Phe	Leu	Val	Ala	Ala	Gly	Thr	Tyr	Glu	Pro	Gln			
			500						505					510					
	Tyr	Ala	Lys	Cys	Arg	Phe	Leu	Phe	Thr	Lys	Val	Ala	Cys	Leu	Gln	Thr			
		515						520					525						
	Val	Leu	Asp	Asp	Met	Tyr	Asp	Thr	Tyr	Gly	Thr	Leu	Asp	Glu	Leu	Lys			
		530				535						540							
	Leu	Phe	Thr	Glu	Ala	Val	Arg	Arg	Trp	Asp	Leu	Ser	Phe	Thr	Glu	Asn			
545					550					555						560			
	Leu	Pro	Asp	Tyr	Met	Lys	Leu	Cys	Tyr	Gln	Ile	Tyr	Tyr	Asp	Ile	Val			
				565						570					575				

His	Glu	Val	Ala	Trp	Glu	Ala	Glu	Lys	Glu	Gln	Gly	Arg	Glu	Leu	Val	
			580					585					590			
Ser	Phe	Phe	Arg	Lys	Gly	Trp	Glu	Asp	Tyr	Leu	Leu	Gly	Tyr	Tyr	Glu	
		595					600					605				
Glu	Ala	Glu	Trp	Leu	Ala	Ala	Glu	Tyr	Val	Pro	Thr	Leu	Asp	Glu	Tyr	
	610				615						620					
Ile	Lys	Asn	Gly	Ile	Thr	Ser	Ile	Gly	Gln	Arg	Ile	Leu	Leu	Leu	Ser	
625					630					635					640	
Gly	Val	Leu	Ile	Met	Asp	Gly	Gln	Leu	Leu	Ser	Gln	Glu	Ala	Leu	Glu	
				645					650					655		
Lys	Val	Asp	Tyr	Pro	Gly	Arg	Arg	Val	Leu	Thr	Glu	Leu	Asn	Ser	Leu	
		660						665					670			
Ile	Ser	Arg	Leu	Ala	Asp	Asp	Thr	Lys	Thr	Tyr	Lys	Ala	Glu	Lys	Ala	
		675					680					685				
Arg	Gly	Glu	Leu	Ala	Ser	Ser	Ile	Glu	Cys	Tyr	Met	Lys	Asp	His	Pro	
	690					695					700					
Glu	Cys	Thr	Glu	Glu	Glu	Ala	Leu	Asp	His	Ile	Tyr	Ser	Ile	Leu	Glu	
705					710					715					720	
Pro	Ala	Val	Lys	Glu	Leu	Thr	Arg	Glu	Phe	Leu	Lys	Pro	Asp	Asp	Val	
			725						730					735		
Pro	Phe	Ala	Cys	Lys	Lys	Met	Leu	Phe	Glu	Glu	Thr	Arg	Val	Thr	Met	
		740						745					750			
Val	Ile	Phe	Lys	Asp	Gly	Asp	Gly	Phe	Gly	Val	Ser	Lys	Leu	Glu	Val	
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 <212> DNA
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 <220>
 <221> CDS
 <222> (1)...(1746)
 <223> d-selinene synthase

<400> 47

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Met	Ala	Glu	Ile	Ser	Glu	Ser	Ser	Ile	Pro	Arg	Arg	Thr	Gly	Asn	His	
1				5					10					15		
cac	gga	aat	gtg	tgg	gac	gat	gac	ctc	ata	cac	tct	ctc	aac	tcg	ccc	96
His	Gly	Asn	Val	Trp	Asp	Asp	Asp	Leu	Ile	His	Ser	Leu	Asn	Ser	Pro	
			20					25					30			
tat	ggg	gca	cct	gca	tat	tat	gag	ctc	ctt	caa	aag	ctt	att	cag	gag	144
Tyr	Gly	Ala	Pro	Ala	Tyr	Tyr	Glu	Leu	Leu	Gln	Lys	Leu	Ile	Gln	Glu	
		35					40					45				
atc	aag	cat	tta	ctt	ttg	act	gaa	atg	gaa	atg	gat	gat	ggc	gat	cat	192
Ile	Lys	His	Leu	Leu	Leu	Thr	Glu	Met	Glu	Met	Asp	Asp	Gly	Asp	His	
	50					55					60					

gat Asp 65	tta Leu	atc Ile	aaa Lys	cgt Arg	ctt Leu 70	cag Gln	atc Ile	gtt Val	gac Asp	act Thr 75	ttg Leu	gaa Glu	tgc Cys	ctg Leu	gga Gly 80	240
atc Ile	gat Asp	aga Arg	cat His	ttt Phe 85	gaa Glu	cac His	gaa Glu	ata Ile	caa Gln 90	aca Thr	gct Ala	gct Ala	tta Leu	gat Asp 95	tac Tyr	288
gtt Val	tac Tyr	aga Arg	tgg Trp 100	tgg Trp	aac Asn	gaa Glu	aaa Lys	ggg Gly 105	atc Ile	ggg Gly	gag Glu	gga Gly	tca Ser 110	aga Arg	gat Asp	336
tcc Ser	ttc Phe	agc Ser 115	aaa Lys	gat Asp	ctg Leu	aac Asn	gct Ala 120	acg Thr	gct Ala	tta Leu	gga Gly	ttt Phe 125	cgc Arg	gct Ala	ctc Leu	384
cga Arg 130	ctg Leu	cat His	cga Arg	tat Tyr	aac Asn 135	gta Val	tcg Ser	tca Ser	ggg Gly	gtg Val	ttg Leu 140	aag Lys	aat Asn	ttc Phe	aag Lys	432
gat Asp 145	gaa Glu	aac Asn	ggg Gly	aag Lys	ttc Phe 150	ttc Phe	tgc Cys	aac Asn	ttt Phe	act Thr 155	ggg Gly	gaa Glu	gaa Glu	gga Gly	aga Arg 160	480
gga Gly	gat Asp	aaa Lys	caa Gln	gtg Val 165	aga Arg	agc Ser	atg Met	ttg Leu	tcg Ser 170	tta Leu	ctt Leu	cga Arg	gct Ala	tca Ser 175	gag Glu	528
att Ile	tcg Ser	ttt Phe	ccc Pro 180	gga Gly	gaa Glu	aaa Lys	gtg Val 185	atg Met	gaa Glu	gag Glu	gcc Ala	aag Lys	gca Ala 190	ttc Phe	aca Thr	576
aga Arg	gaa Glu	tat Tyr 195	cta Leu	aac Asn	caa Gln	gtt Val	tta Leu 200	gct Ala	gga Gly	cac His	ggg Gly	gat Asp 205	gtg Val	act Thr	gac Asp	624
gtg Val 210	gat Asp	caa Gln	agc Ser	ctt Leu	ttg Leu	aga Arg 215	gag Glu	gtg Val	aag Lys	tac Tyr	gca Ala 220	ttg Leu	gag Glu	ttt Phe	cca Pro	672
tgg Trp 225	cat His	tgc Cys	agt Ser	gtg Val	ccg Pro 230	aga Arg	tgg Trp	gag Glu	gca Ala 235	agg Arg	agc Ser	ttt Phe	ctc Leu	gaa Glu	ata Ile 240	720
tat Tyr	gga Gly	cac His	aac Asn	cat His 245	tcg Ser	tgg Trp	ctc Leu	aag Lys	tcg Ser 250	aat Asn	atc Ile	aac Asn	caa Gln	aaa Lys 255	atg Met	768
ttg Leu	aag Lys	tta Leu	gcc Ala 260	aaa Lys	ttg Leu	gac Asp	ttc Phe	aat Asn 265	att Ile	ctg Leu	caa Gln	tgc Cys	aaa Lys 270	cat His	cac His	816

aag	gag	ata	cag	ttt	att	aca	agg	tgg	tgg	aga	gac	tcg	ggg	ata	tcg	864
Lys	Glu	Ile	Gln	Phe	Ile	Thr	Arg	Trp	Trp	Arg	Asp	Ser	Gly	Ile	Ser	
		275					280					285				
cag	ctg	aat	ttc	tat	cga	aag	cga	cac	gtg	gaa	tat	tat	tct	tgg	gtt	912
Gln	Leu	Asn	Phe	Tyr	Arg	Lys	Arg	His	Val	Glu	Tyr	Tyr	Ser	Trp	Val	
	290					295					300					
gtt	atg	tgc	att	ttt	gag	cca	gag	ttc	tct	gaa	agt	aga	att	gcc	ttc	960
Val	Met	Cys	Ile	Phe	Glu	Pro	Glu	Phe	Ser	Glu	Ser	Arg	Ile	Ala	Phe	
305					310					315					320	
gcc	aaa	act	gct	atc	ctg	tgt	act	gtt	cta	gat	gac	ctc	tat	gat	acg	1008
Ala	Lys	Thr	Ala	Ile	Leu	Cys	Thr	Val	Leu	Asp	Asp	Leu	Tyr	Asp	Thr	
				325					330					335		
cac	gca	aca	ttg	cat	gaa	atc	aaa	atc	atg	aca	gag	gga	gtg	aga	cga	1056
His	Ala	Thr	Leu	His	Glu	Ile	Lys	Ile	Met	Thr	Glu	Gly	Val	Arg	Arg	
			340					345					350			
tgg	gat	ctt	tcg	ttg	aca	gat	gac	ctc	cca	gac	tac	att	aaa	att	gca	1104
Trp	Asp	Leu	Ser	Leu	Thr	Asp	Asp	Leu	Pro	Asp	Tyr	Ile	Lys	Ile	Ala	
		355					360					365				
ttc	cag	ttc	ttc	ttc	aat	aca	gtg	aat	gaa	ttg	ata	gtt	gaa	atc	gtg	1152
Phe	Gln	Phe	Phe	Phe	Asn	Thr	Val	Asn	Glu	Leu	Ile	Val	Glu	Ile	Val	
	370					375					380					
aaa	cgg	caa	ggg	cgg	gat	atg	aca	acc	ata	gtt	aaa	gat	tgc	tgg	aag	1200
Lys	Arg	Gln	Gly	Arg	Asp	Met	Thr	Thr	Ile	Val	Lys	Asp	Cys	Trp	Lys	
385					390					395					400	
cga	tac	att	gag	tct	tat	ctg	caa	gaa	gcg	gaa	tgg	ata	gca	act	gga	1248
Arg	Tyr	Ile	Glu	Ser	Tyr	Leu	Gln	Glu	Ala	Glu	Trp	Ile	Ala	Thr	Gly	
			405					410						415		
cat	att	ccc	act	ttt	aac	gaa	tac	ata	aag	aac	ggc	atg	gct	agc	tca	1296
His	Ile	Pro	Thr	Phe	Asn	Glu	Tyr	Ile	Lys	Asn	Gly	Met	Ala	Ser	Ser	
			420					425					430			
ggg	atg	tgt	att	cta	aat	ttg	aat	cca	ctt	ctc	ttg	ttg	gat	aaa	ctt	1344
Gly	Met	Cys	Ile	Leu	Asn	Leu	Asn	Pro	Leu	Leu	Leu	Leu	Asp	Lys	Leu	
		435					440					445				
ctc	ccc	gac	aac	att	ctg	gag	caa	ata	cat	tct	cca	tcc	aag	atc	ctg	1392
Leu	Pro	Asp	Asn	Ile	Leu	Glu	Gln	Ile	His	Ser	Pro	Ser	Lys	Ile	Leu	
	450					455					460					
gac	ctc	tta	gaa	ttg	acg	ggc	aga	atc	gcc	gat	gac	tta	aaa	gat	ttc	1440
Asp	Leu	Leu	Glu	Leu	Thr	Gly	Arg	Ile	Ala	Asp	Asp	Leu	Lys	Asp	Phe	
465					470					475					480	
gag	gac	gag	aag	gaa	cgc	ggg	gag	atg	gct	tca	tct	tta	cag	tgt	tat	1488

Glu	Asp	Glu	Lys	Glu	Arg	Gly	Glu	Met	Ala	Ser	Ser	Leu	Gln	Cys	Tyr		
				485					490					495			
atg	aaa	gaa	aat	cct	gaa	tct	aca	gtg	gaa	aat	gct	tta	aac	cac	ata		1536
Met	Lys	Glu	Asn	Pro	Glu	Ser	Thr	Val	Glu	Asn	Ala	Leu	Asn	His	Ile		
			500					505					510				
aaa	ggc	atc	ctt	aat	cgt	tcc	ctt	gag	gaa	ttt	aat	tgg	gag	ttt	atg		1584
Lys	Gly	Ile	Leu	Asn	Arg	Ser	Leu	Glu	Glu	Phe	Asn	Trp	Glu	Phe	Met		
		515					520					525					
aag	cag	gat	agt	gtc	cca	atg	tgt	tgc	aag	aaa	ttc	act	ttc	aat	ata		1632
Lys	Gln	Asp	Ser	Val	Pro	Met	Cys	Cys	Lys	Lys	Phe	Thr	Phe	Asn	Ile		
	530					535					540						
ggc	cga	gga	ctt	caa	ttc	atc	tac	aaa	tac	aga	gac	ggc	tta	tac	att		1680
Gly	Arg	Gly	Leu	Gln	Phe	Ile	Tyr	Lys	Tyr	Arg	Asp	Gly	Leu	Tyr	Ile		
545				550					555						560		
tct	gac	aag	gaa	gta	aag	gac	cag	ata	ttc	aaa	att	cta	gtc	cac	caa		1728
Ser	Asp	Lys	Glu	Val	Lys	Asp	Gln	Ile	Phe	Lys	Ile	Leu	Val	His	Gln		
				565				570						575			
gtt	cca	atg	gag	gaa	tag	tgatgggtcctt	ggttgtagtt	gtctattatg									1776
Val	Pro	Met	Glu	Glu	*												
			580														
gtatattgca	ttgacatttta	tgcttaaagg	tgtttcttaa	acgttttaggg	cggaccggtta												1836
aataagttgg	caataattaa	tatctcgag															1865

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 <213> Abies grandis

<400> 48																	
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His	Gly	Asn	Val	Trp	Asp	Asp	Asp	Leu	Ile	His	Ser	Leu	Asn	Ser	Pro		
			20					25					30				
Tyr	Gly	Ala	Pro	Ala	Tyr	Tyr	Glu	Leu	Leu	Gln	Lys	Leu	Ile	Gln	Glu		
		35					40					45					
Ile	Lys	His	Leu	Leu	Leu	Thr	Glu	Met	Glu	Met	Asp	Asp	Gly	Asp	His		
	50					55					60						
Asp	Leu	Ile	Lys	Arg	Leu	Gln	Ile	Val	Asp	Thr	Leu	Glu	Cys	Leu	Gly		
65				70					75					80			
Ile	Asp	Arg	His	Phe	Glu	His	Glu	Ile	Gln	Thr	Ala	Ala	Leu	Asp	Tyr		
			85					90						95			
Val	Tyr	Arg	Trp	Trp	Asn	Glu	Lys	Gly	Ile	Gly	Glu	Gly	Ser	Arg	Asp		
			100					105					110				
Ser	Phe	Ser	Lys	Asp	Leu	Asn	Ala	Thr	Ala	Leu	Gly	Phe	Arg	Ala	Leu		
		115				120						125					
Arg	Leu	His	Arg	Tyr	Asn	Val	Ser	Ser	Gly	Val	Leu	Lys	Asn	Phe	Lys		

130						135					140				
Asp	Glu	Asn	Gly	Lys	Phe	Phe	Cys	Asn	Phe	Thr	Gly	Glu	Glu	Gly	Arg
145					150					155					160
Gly	Asp	Lys	Gln	Val	Arg	Ser	Met	Leu	Ser	Leu	Leu	Arg	Ala	Ser	Glu
				165						170					175
Ile	Ser	Phe	Pro	Gly	Glu	Lys	Val	Met	Glu	Glu	Ala	Lys	Ala	Phe	Thr
			180					185					190		
Arg	Glu	Tyr	Leu	Asn	Gln	Val	Leu	Ala	Gly	His	Gly	Asp	Val	Thr	Asp
		195					200				205				
Val	Asp	Gln	Ser	Leu	Leu	Arg	Glu	Val	Lys	Tyr	Ala	Leu	Glu	Phe	Pro
	210					215					220				
Trp	His	Cys	Ser	Val	Pro	Arg	Trp	Glu	Ala	Arg	Ser	Phe	Leu	Glu	Ile
225					230					235					240
Tyr	Gly	His	Asn	His	Ser	Trp	Leu	Lys	Ser	Asn	Ile	Asn	Gln	Lys	Met
			245					250						255	
Leu	Lys	Leu	Ala	Lys	Leu	Asp	Phe	Asn	Ile	Leu	Gln	Cys	Lys	His	His
			260				265						270		
Lys	Glu	Ile	Gln	Phe	Ile	Thr	Arg	Trp	Trp	Arg	Asp	Ser	Gly	Ile	Ser
		275				280					285				
Gln	Leu	Asn	Phe	Tyr	Arg	Lys	Arg	His	Val	Glu	Tyr	Tyr	Ser	Trp	Val
	290				295					300					
Val	Met	Cys	Ile	Phe	Glu	Pro	Glu	Phe	Ser	Glu	Ser	Arg	Ile	Ala	Phe
305					310					315					320
Ala	Lys	Thr	Ala	Ile	Leu	Cys	Thr	Val	Leu	Asp	Asp	Leu	Tyr	Asp	Thr
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His	Ala	Thr	Leu	His	Glu	Ile	Lys	Ile	Met	Thr	Glu	Gly	Val	Arg	Arg
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Trp	Asp	Leu	Ser	Leu	Thr	Asp	Asp	Leu	Pro	Asp	Tyr	Ile	Lys	Ile	Ala
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Phe	Gln	Phe	Phe	Phe	Asn	Thr	Val	Asn	Glu	Leu	Ile	Val	Glu	Ile	Val
	370				375						380				
Lys	Arg	Gln	Gly	Arg	Asp	Met	Thr	Thr	Ile	Val	Lys	Asp	Cys	Trp	Lys
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Arg	Tyr	Ile	Glu	Ser	Tyr	Leu	Gln	Glu	Ala	Glu	Trp	Ile	Ala	Thr	Gly
			405					410						415	
His	Ile	Pro	Thr	Phe	Asn	Glu	Tyr	Ile	Lys	Asn	Gly	Met	Ala	Ser	Ser
		420					425					430			
Gly	Met	Cys	Ile	Leu	Asn	Leu	Asn	Pro	Leu	Leu	Leu	Leu	Asp	Lys	Leu
	435					440					445				
Leu	Pro	Asp	Asn	Ile	Leu	Glu	Gln	Ile	His	Ser	Pro	Ser	Lys	Ile	Leu
	450				455						460				
Asp	Leu	Leu	Glu	Leu	Thr	Gly	Arg	Ile	Ala	Asp	Asp	Leu	Lys	Asp	Phe
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Glu	Asp	Glu	Lys	Glu	Arg	Gly	Glu	Met	Ala	Ser	Ser	Leu	Gln	Cys	Tyr
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Met	Lys	Glu	Asn	Pro	Glu	Ser	Thr	Val	Glu	Asn	Ala	Leu	Asn	His	Ile
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Lys	Gln	Asp	Ser	Val	Pro	Met	Cys	Cys	Lys	Lys	Phe	Thr	Phe	Asn	Ile
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<223> gamma-humulene synthase

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Ser Thr Glu Ser Ser Ile Thr Ser Asn Arg His Gly Asn Met Trp Glu 30
20 25
gac gat cgc ata cag tct ctc aac tca cct tat ggg gca cct gca tat 144
Asp Asp Arg Ile Gln Ser Leu Asn Ser Pro Tyr Gly Ala Pro Ala Tyr 45
35 40
caa gaa cgc agc gaa aag ctt att gaa gag atc aaa ctt tta ttt ttg 192
Gln Glu Arg Ser Glu Lys Leu Ile Glu Glu Ile Lys Leu Leu Phe Leu 60
50 55
agt gac atg gac gat agc tgc aat gat agc gat cgt gat tta atc aaa 240
Ser Asp Met Asp Asp Ser Cys Asn Asp Ser Asp Arg Asp Leu Ile Lys 75
65 70
cgt ctt gag atc gtt gat act gtc gag tgt ctg gga att gat cga cat 288
Arg Leu Glu Ile Val Asp Thr Val Glu Cys Leu Gly Ile Asp Arg His 95
80 85 90
ttt caa cct gag ata aaa tta gct ctg gat tac gtt tac aga tgt tgg 336
Phe Gln Pro Glu Ile Lys Leu Ala Leu Asp Tyr Val Tyr Arg Cys Trp 110
100 105
aac gaa aga ggc atc gga gag gga tca aga gat tcc ctc aag aaa gat 384
Asn Glu Arg Gly Ile Gly Glu Gly Ser Arg Asp Ser Leu Lys Lys Asp 125
115 120
ctg aac gct aca gct ttg gga ttc cgg gct ctc cga ctc cat cga tat 432
Leu Asn Ala Thr Ala Leu Gly Phe Arg Ala Leu Arg Leu His Arg Tyr 140
130 135
aac gta tcc tca ggt gtc ttg gag aat ttc aga gat gat aac ggg cag 480

Asn	Val	Ser	Ser	Gly	Val	Leu	Glu	Asn	Phe	Arg	Asp	Asp	Asn	Gly	Gln	
145						150					155					
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Phe	Phe	Cys	Gly	Ser	Thr	Val	Glu	Glu	Glu	Gly	Ala	Glu	Ala	Tyr	Asn	
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Lys	His	Val	Arg	Cys	Met	Leu	Ser	Leu	Ser	Arg	Ala	Ser	Asn	Ile	Leu	
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Tyr	Leu	Lys	Lys	Val	Leu	Ala	Gly	Arg	Glu	Ala	Thr	His	Val	Asp	Glu	
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Ser	Leu	Leu	Gly	Glu	Val	Lys	Tyr	Ala	Leu	Glu	Phe	Pro	Trp	His	Cys	
	225					230					235					
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Ser	Val	Gln	Arg	Trp	Glu	Ala	Arg	Ser	Phe	Ile	Glu	Ile	Phe	Gly	Gln	
240					245					250					255	
att	gat	tca	gag	ctt	aag	tcg	aat	ttg	agc	aaa	aaa	atg	tta	gag	ttg	816
Ile	Asp	Ser	Glu	Leu	Lys	Ser	Asn	Leu	Ser	Lys	Lys	Met	Leu	Glu	Leu	
				260					265					270		
gcg	aaa	ttg	gac	ttc	aat	att	ctg	caa	tgc	aca	cat	cag	aaa	gaa	ctg	864
Ala	Lys	Leu	Asp	Phe	Asn	Ile	Leu	Gln	Cys	Thr	His	Gln	Lys	Glu	Leu	
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cag	att	atc	tca	agg	tgg	ttc	gca	gac	tca	agt	ata	gca	tcc	ctg	aat	912
Gln	Ile	Ile	Ser	Arg	Trp	Phe	Ala	Asp	Ser	Ser	Ile	Ala	Ser	Leu	Asn	
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ttc	tat	cgg	aaa	tgt	tac	gtc	gaa	ttt	tac	ttt	tgg	atg	gct	gca	gcc	960
Phe	Tyr	Arg	Lys	Cys	Tyr	Val	Glu	Phe	Tyr	Phe	Trp	Met	Ala	Ala	Ala	
	305					310					315					
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Ile	Ser	Glu	Pro	Glu	Phe	Ser	Gly	Ser	Arg	Val	Ala	Phe	Thr	Lys	Ile	
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gct	ata	ctg	atg	aca	atg	cta	gat	gac	ctg	tac	gat	act	cac	gga	acc	1056
Ala	Ile	Leu	Met	Thr	Met	Leu	Asp	Asp	Leu	Tyr	Asp	Thr	His	Gly	Thr	
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Leu	Asp	Gln	Leu	Lys	Ile	Phe	Thr	Glu	Gly	Val	Arg	Arg	Trp	Asp	Val	

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Trp	Leu	Lys	Thr	Ser	Asn	Glu	Leu	Ile	Ala	Glu	Ala	Val	Lys	Ala	Gln		
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Gly	Gln	Asp	Met	Ala	Ala	Tyr	Ile	Arg	Lys	Asn	Ala	Trp	Glu	Arg	Tyr		
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				420					425					430			
ccc	acc	ttt	gat	gag	tac	ttg	aat	aat	ggc	aca	cca	aac	act	ggg	atg	1344	
Pro	Thr	Phe	Asp	Glu	Tyr	Leu	Asn	Asn	Gly	Thr	Pro	Asn	Thr	Gly	Met		
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Cys	Val	Leu	Asn	Leu	Ile	Pro	Leu	Leu	Leu	Met	Gly	Glu	His	Leu	Pro		
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att	gaa	ttg	gct	tcc	agg	ctc	gtc	gat	gac	gcg	aga	gat	ttc	cag	gcg	1488	
Ile	Glu	Leu	Ala	Ser	Arg	Leu	Val	Asp	Asp	Ala	Arg	Asp	Phe	Gln	Ala		
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gag	aag	gat	cat	ggg	gat	tta	tcg	tgt	att	gag	tgt	tat	tta	aaa	gat	1536	
Glu	Lys	Asp	His	Gly	Asp	Leu	Ser	Cys	Ile	Glu	Cys	Tyr	Leu	Lys	Asp		
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cat	cct	gag	tct	aca	gta	gaa	gat	gct	tta	aat	cat	gtt	aat	ggc	ctc	1584	
His	Pro	Glu	Ser	Thr	Val	Glu	Asp	Ala	Leu	Asn	His	Val	Asn	Gly	Leu		
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cga	agc	atc	caa	ttc	atg	tac	aat	caa	ggc	gat	ggc	ttc	tcc	att	tcg	1728	
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Asn	Lys	Val	Ile	Lys	Asp	Gln	Val	Gln	Lys	Val	Leu	Ile	Val	Pro	Val	
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Pro	Ile	*														

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Asp	Arg	Ile	Gln	Ser	Leu	Asn	Ser	Pro	Tyr	Gly	Ala	Pro	Ala	Tyr	Gln
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Glu	Arg	Ser	Glu	Lys	Leu	Ile	Glu	Glu	Ile	Lys	Leu	Phe	Leu	Ser	
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Asp	Met	Asp	Asp	Ser	Cys	Asn	Asp	Ser	Asp	Arg	Asp	Leu	Ile	Lys	Arg
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Leu	Glu	Ile	Val	Asp	Thr	Val	Glu	Cys	Leu	Gly	Ile	Asp	Arg	His	Phe
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Gln	Pro	Glu	Ile	Lys	Leu	Ala	Leu	Asp	Tyr	Val	Tyr	Arg	Cys	Trp	Asn
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Glu	Arg	Gly	Ile	Gly	Glu	Gly	Ser	Arg	Asp	Ser	Leu	Lys	Lys	Asp	Leu
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Asn	Ala	Thr	Ala	Leu	Gly	Phe	Arg	Ala	Leu	Arg	Leu	His	Arg	Tyr	Asn
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Val	Ser	Ser	Gly	Val	Leu	Glu	Asn	Phe	Arg	Asp	Asp	Asn	Gly	Gln	Phe
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Phe	Cys	Gly	Ser	Thr	Val	Glu	Glu	Glu	Gly	Ala	Glu	Ala	Tyr	Asn	Lys
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His	Val	Arg	Cys	Met	Leu	Ser	Leu	Ser	Arg	Ala	Ser	Asn	Ile	Leu	Phe
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Ile	Ile	Ser	Arg	Trp	Phe	Ala	Asp	Ser	Ser	Ile	Ala	Ser	Leu	Asn	Phe

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Ser	Glu	Pro	Glu	Phe	Ser	Gly	Ser	Arg	Val	Ala	Phe	Thr	Lys	Ile	Ala	
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Ile	Leu	Met	Thr	Met	Leu	Asp	Asp	Leu	Tyr	Asp	Thr	His	Gly	Thr	Leu	
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385					390					395					400	
Gln	Asp	Met	Ala	Ala	Tyr	Ile	Arg	Lys	Asn	Ala	Trp	Glu	Arg	Tyr	Leu	
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Glu	Leu	Ala	Ser	Arg	Leu	Val	Asp	Asp	Ala	Arg	Asp	Phe	Gln	Ala	Glu	
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Lys	Asp	His	Gly	Asp	Leu	Ser	Cys	Ile	Glu	Cys	Tyr	Leu	Lys	Asp	His	
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Pro	Glu	Ser	Thr	Val	Glu	Asp	Ala	Leu	Asn	His	Val	Asn	Gly	Leu	Leu	
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Gly	Asn	Cys	Leu	Leu	Glu	Met	Asn	Trp	Lys	Phe	Leu	Lys	Lys	Gln	Asp	
	530				535						540					
Ser	Val	Pro	Leu	Ser	Cys	Lys	Lys	Tyr	Ser	Phe	His	Val	Leu	Ala	Arg	
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Asp	Glu	Tyr	Lys	Glu	Thr	Ile	Arg	Lys	Met	Leu	Val	Glu	Thr	Cys	Asp		
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Asn	Ser	Thr	Gln	Lys	Leu	Val	Leu	Ile	Asp	Ala	Met	Gln	Arg	Leu	Gly		
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Val	Ala	Tyr	His	Phe	Asp	Asn	Glu	Ile	Glu	Thr	Ser	Ile	Gln	Asn	Ile		
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Phe	Asp	Ala	Ser	Ser	Lys	Gln	Asn	Asp	Asn	Asp	Asn	Asn	Leu	Tyr	Val		
		90					95					100					
gtg	tct	ctt	cgt	ttt	cga	ctt	gtg	agg	caa	caa	ggc	cat	tac	atg	tct		388
Val	Ser	Leu	Arg	Phe	Arg	Leu	Val	Arg	Gln	Gln	Gly	His	Tyr	Met	Ser		
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Ser	Asp	Val	Phe	Lys	Gln	Phe	Thr	Asn	Gln	Asp	Gly	Lys	Phe	Lys	Glu		
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His	Leu	Arg	Val	Arg	Asn	Glu	Glu	Ile	Leu	Glu	Glu	Ala	Leu	Thr	Phe		
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Thr	Thr	Thr	His	Leu	Glu	Ser	Ile	Val	Ser	Asn	Leu	Ser	Asn	Asn	Asn		
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aac	tct	ctt	aag	gtt	gaa	gtt	ggt	gaa	gcc	tta	act	cag	cct	att	cgc		628
Asn	Ser	Leu	Lys	Val	Glu	Val	Gly	Glu	Ala	Leu	Thr	Gln	Pro	Ile	Arg		
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Met	Thr	Leu	Pro	Arg	Met	Gly	Ala	Arg	Lys	Tyr	Ile	Ser	Ile	Tyr	Glu		
	200				205					210					215		

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gac Asp	agg Arg 265	ttg Leu	gtt Val	gag Glu	tgt Cys	tac Tyr 270	ttc Phe	tgg Trp	ata Ile	tta Leu	gga Gly 275	gtg Val	tat Tyr	ttt Phe	gag Glu	868
cca Pro 280	aaa Lys	tat Tyr	agt Ser	cgt Arg	gcg Ala 285	aga Arg	aaa Lys	atg Met	atg Met	aca Thr 290	aaa Lys	gta Val	ctc Leu	aac Asn	ctg Leu 295	916
acc Thr	tcc Ser	att Ile	att Ile	gac Asp 300	gac Asp	act Thr	ttt Phe	gat Asp	gct Ala 305	tat Tyr	gca Ala	acc Thr	ttt Phe 310	gac Asp 310	gaa Glu	964
ctt Leu	gtg Val	act Thr	ttc Phe 315	aat Asn	gat Asp	gca Ala	atc Ile	cag Gln 320	aga Arg	tgg Trp	gat Asp	gct Ala	aat Asn 325	gca Ala	att Ile	1012
gat Asp	tca Ser	ata Ile	caa Gln	cca Pro	tat Tyr	atg Met	aga Arg 335	cct Pro	gct Ala	tat Tyr	caa Gln	gct Ala 340	ctt Leu	cta Leu	gac Asp	1060
att Ile	tac Tyr	agt Ser	gaa Glu	atg Met	gaa Glu	caa Gln 350	gtg Val	ttg Leu	tcc Ser	aaa Lys	gaa Glu 355	ggg Gly	aaa Lys	ctg Leu	gac Asp	1108
cgt Arg 360	gta Val	tac Tyr	tat Tyr	gca Ala	aaa Lys 365	aat Asn	gag Glu	atg Met	aaa Lys	aag Lys 370	ttg Leu	gtg Val	aga Arg	gcc Ala	tat Tyr 375	1156
ttt Phe	aag Lys	gaa Glu	acc Thr	caa Gln 380	tgg Trp	ttg Leu	aat Asn	gat Asp	tgt Cys 385	gac Asp	cat His	att Ile	cca Pro	aaa Lys 390	tat Tyr	1204
gag Glu	gaa Glu	caa Gln	gtg Val 395	gag Glu	aat Asn	gca Ala	atc Ile	gta Val 400	agt Ser	gct Ala	ggc Gly	tat Tyr	atg Met 405	atg Met	ata Ile	1252
tca Ser	aca Thr	act Thr 410	tgc Cys	ttg Leu	gtc Val	ggg Gly	ata Ile 415	gaa Glu	gaa Glu	ttt Phe	ata Ile	tcc Ser 420	cac His	gag Glu	act Thr	1300

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Phe Glu Trp Leu Met Asn Glu Ser Val Ile Val Arg Ala Ser Ala Leu	
425 430 435	
att gcc aga gca atg aac gat att gtt gga cat gaa gat gaa caa gaa	1396
Ile Ala Arg Ala Met Asn Asp Ile Val Gly His Glu Asp Glu Gln Glu	
440 445 450 455	
aga gga cat gta gct tca ctt att gaa tgt tac atg aaa gat tat gga	1444
Arg Gly His Val Ala Ser Leu Ile Glu Cys Tyr Met Lys Asp Tyr Gly	
460 465 470	
gct tca aag caa gag act tac att aag ttc ctg aaa gag gtc acc aat	1492
Ala Ser Lys Gln Glu Thr Tyr Ile Lys Phe Leu Lys Glu Val Thr Asn	
475 480 485	
gca tgg aag gac ata aac aaa caa ttc tcc cgt cca act gaa gta cca	1540
Ala Trp Lys Asp Ile Asn Lys Gln Phe Ser Arg Pro Thr Glu Val Pro	
490 495 500	
atg ttt gtc ctt gaa cga gtt cta aat ttg aca cgt gtg gct gac acg	1588
Met Phe Val Leu Glu Arg Val Leu Asn Leu Thr Arg Val Ala Asp Thr	
505 510 515	
tta tat aag gag aaa gat aca tat tca acc gcc aaa gga aaa ctt aaa	1636
Leu Tyr Lys Glu Lys Asp Thr Tyr Ser Thr Ala Lys Gly Lys Leu Lys	
520 525 530 535	
aac atg att aat cca ata cta att gaa tct gtc aaa ata taa	1678
Asn Met Ile Asn Pro Ile Leu Ile Glu Ser Val Lys Ile *	
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taaattgaag actcacaaca tatgagttgt taattcctgg gatgtttgaa ataaacaata	1798
attgttttta tttaatttgc taagccaaag tgaaatatac aacacttgag ttgtattaaa	1858
tcatgtttta tctcatttcc agcttgtgag tttggattat tatattgtta attatcatca	1918
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<210> 52

<211> 548

<212> PRT

<213> Lycopersicon esculentum

<400> 52

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35 40 45	
Met Leu Val Glu Thr Cys Asp Asn Ser Thr Gln Lys Leu Val Leu Ile	
50 55 60	

Asp 65	Ala	Met	Gln	Arg	Leu 70	Gly	Val	Ala	Tyr	His 75	Phe	Asp	Asn	Glu	Ile 80
Glu	Thr	Ser	Ile	Gln 85	Asn	Ile	Phe	Asp	Ala 90	Ser	Ser	Lys	Gln	Asn	Asp 95
Asn	Asp	Asn	Asn 100	Leu	Tyr	Val	Val	Ser	Leu 105	Arg	Phe	Arg	Leu	Val	Arg 110
Gln	Gln	Gly 115	His	Tyr	Met	Ser	Ser	Asp	Val 120	Phe	Lys	Gln	Phe	Thr	Asn 125
Gln	Asp 130	Gly	Lys	Phe	Lys	Glu 135	Thr	Leu	Thr	Asn	Asp 140	Val	Gln	Gly	Leu
Leu 145	Ser	Leu	Tyr	Glu	Ala 150	Ser	His	Leu	Arg	Val	Arg	Asn	Glu	Glu	Ile 160
Leu	Glu	Glu	Ala	Leu 165	Thr	Phe	Thr	Thr	Thr	His 170	Leu	Glu	Ser	Ile	Val 175
Ser	Asn	Leu	Ser 180	Asn	Asn	Asn	Asn	Ser	Leu 185	Lys	Val	Glu	Val	Gly	Glu 190
Ala	Leu	Thr 195	Gln	Pro	Ile	Arg	Met 200	Thr	Leu	Pro	Arg	Met 205	Gly	Ala	Arg
Lys	Tyr 210	Ile	Ser	Ile	Tyr	Glu 215	Asn	Asn	Asp	Ala	His 220	His	His	Leu	Leu
Leu 225	Lys	Phe	Ala	Lys	Leu 230	Asp	Phe	Asn	Met	Leu 235	Gln	Lys	Phe	His	Gln 240
Arg	Glu	Leu	Ser	Asp 245	Leu	Thr	Arg	Trp	Trp 250	Lys	Asp	Leu	Asp	Phe	Ala 255
Asn	Lys	Tyr	Pro 260	Tyr	Ala	Arg	Asp	Arg	Leu 265	Val	Glu	Cys	Tyr	Phe	Trp 270
Ile	Leu 275	Gly	Val	Tyr	Phe	Glu 280	Pro	Lys	Tyr	Ser	Arg	Ala 285	Arg	Lys	Met
Met	Thr 290	Lys	Val	Leu	Asn 295	Leu	Thr	Ser	Ile	Ile	Asp 300	Asp	Thr	Phe	Asp
Ala 305	Tyr	Ala	Thr	Phe	Asp 310	Glu	Leu	Val	Thr	Phe 315	Asn	Asp	Ala	Ile	Gln 320
Arg	Trp	Asp	Ala	Asn 325	Ala	Ile	Asp	Ser	Ile 330	Gln	Pro	Tyr	Met	Arg	Pro 335
Ala	Tyr	Gln	Ala 340	Leu	Leu	Asp	Ile	Tyr	Ser 345	Glu	Met	Glu	Gln	Val	Leu 350
Ser	Lys 355	Glu	Gly	Lys	Leu	Asp	Arg 360	Val	Tyr	Tyr	Ala 365	Lys	Asn	Glu	Met
Lys 370	Lys	Leu	Val	Arg	Ala	Tyr 375	Phe	Lys	Glu	Thr	Gln 380	Trp	Leu	Asn	Asp
Cys 385	Asp	His	Ile	Pro	Lys 390	Tyr	Glu	Glu	Gln	Val 395	Glu	Asn	Ala	Ile	Val 400
Ser	Ala	Gly	Tyr	Met 405	Met	Ile	Ser	Thr	Thr 410	Cys	Leu	Val	Gly	Ile	Glu 415
Glu	Phe	Ile	Ser 420	His	Glu	Thr	Phe	Glu 425	Trp	Leu	Met	Asn	Glu	Ser	Val
Ile	Val 435	Arg	Ala	Ser	Ala	Leu 440	Ile	Ala	Arg	Ala 445	Met	Asn	Asp	Ile	Val
Gly	His 450	Glu	Asp	Glu	Gln 455	Glu	Arg	Gly	His	Val 460	Ala	Ser	Leu	Ile	Glu
Cys 465	Tyr	Met	Lys	Asp	Tyr 470	Gly	Ala	Ser	Lys	Gln 475	Glu	Thr	Tyr	Ile	Lys 480
Phe	Leu	Lys	Glu	Val	Thr	Asn	Ala	Trp	Lys	Asp	Ile	Asn	Lys	Gln	Phe

Ser	Arg	Pro	Thr	485	Glu	Val	Pro	Met	Phe	490	Val	Leu	Glu	Arg	Val	Leu	Asn	495
			500						505						510			
Leu	Thr	Arg	Val	Ala	Asp	Thr	Leu	Tyr	Lys	Glu	Lys	Asp	Thr	Tyr	Ser			
		515					520					525						
Thr	Ala	Lys	Gly	Lys	Leu	Lys	Asn	Met	Ile	Asn	Pro	Ile	Leu	Ile	Glu			
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Ser	Val	Lys	Ile															
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								1				5					
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Met	Pro	Leu	Asn	Ser	Leu	His	Asn	Phe	Glu	Arg	Lys	Pro	Ser	Lys	Ala		
10					15					20					25		
tgg	tct	acc	tct	tgc	act	gca	ccc	gca	gct	cgc	ctc	cgg	gca	tct	tcc		148
Trp	Ser	Thr	Ser	Cys	Thr	Ala	Pro	Ala	Ala	Arg	Leu	Arg	Ala	Ser	Ser		
				30					35					40			
tcc	tta	caa	caa	gaa	aaa	cct	cac	caa	atc	cga	cgc	tct	ggg	gat	tac		196
Ser	Leu	Gln	Gln	Glu	Lys	Pro	His	Gln	Ile	Arg	Arg	Ser	Gly	Asp	Tyr		
			45					50					55				
caa	ccc	tct	ctt	tgg	gat	ttc	aat	tac	ata	cag	tct	ctc	aac	act	ccg		244
Gln	Pro	Ser	Leu	Trp	Asp	Phe	Asn	Tyr	Ile	Gln	Ser	Leu	Asn	Thr	Pro		
		60					65					70					
tat	aag	gag	cag	aga	cac	ttt	aat	agg	caa	gca	gag	ttg	att	atg	caa		292
Tyr	Lys	Glu	Gln	Arg	His	Phe	Asn	Arg	Gln	Ala	Glu	Leu	Ile	Met	Gln		
	75				80						85						
gtg	agg	atg	ttg	ctc	aag	gta	aag	atg	gag	gca	att	caa	cag	ttg	gag		340
Val	Arg	Met	Leu	Leu	Lys	Val	Lys	Met	Glu	Ala	Ile	Gln	Gln	Leu	Glu		
	90				95					100					105		
ttg	att	gat	gac	ttg	caa	tac	ctg	gga	ctg	tct	tat	ttc	ttt	caa	gat		388
Leu	Ile	Asp	Asp	Leu	Gln	Tyr	Leu	Gly	Leu	Ser	Tyr	Phe	Phe	Gln	Asp		
				110					115					120			

gag Glu	att Ile	aaa Lys	caa Gln 125	atc Ile	tta Leu	agt Ser	tct Ser	ata Ile 130	cac His	aat Asn	gag Glu	ccc Pro	aga Arg 135	tat Tyr	ttc Phe	436
cac His	aat Asn 140	aat Asn	gat Asp	ttg Leu	tat Tyr	ttc Phe	aca Thr 145	gct Ala	ctt Leu	gga Gly	ttc Phe	aga Arg 150	atc Ile	ctc Leu	aga Arg	484
caa Gln 155	cat His	ggt Gly	ttt Phe	aat Asn	gtt Val	tcc Ser 160	gaa Glu	gat Asp	gta Val	ttt Phe	gat Asp 165	tgt Cys	ttc Phe	aaa Lys	att Ile	532
gag Glu 170	aag Lys	tgc Cys	agt Ser	gat Asp	ttc Phe 175	aat Asn	gca Ala	aac Asn	ctt Leu	gct Ala 180	caa Gln	gat Asp	acg Thr	aag Lys	gga Gly 185	580
atg Met	tta Leu	caa Gln	ctt Leu	tat Tyr 190	gaa Glu	gca Ala	tct Ser	ttc Phe	ctt Leu 195	ttg Leu	aga Arg	gaa Glu	ggt Gly	gaa Glu 200	gat Asp	628
aca Thr	ttg Leu	gag Glu	cta Leu 205	gca Ala	aga Arg	cga Arg	ttt Phe	tcc Ser 210	acc Thr	aga Arg	tct Ser	cta Leu	cga Arg 215	gaa Glu	aaa Lys	676
ttt Phe	gat Asp	gaa Glu 220	ggt Gly	ggt Gly	gat Asp	gaa Glu	att Ile 225	gat Asp	gaa Glu	gat Asp	cta Leu	tca Ser 230	tcg Ser	tgg Trp	att Ile	724
cgc Arg	cat His 235	tcc Ser	ttg Leu	gat Asp	ctt Leu	cct Pro 240	ctt Leu	cat His	tgg Trp	agg Arg	gtc Val 245	caa Gln	gga Gly	tta Leu	gag Glu	772
gca Ala 250	aga Arg	tgg Trp	ttc Phe	tta Leu	gat Asp 255	gct Ala	tat Tyr	gcg Ala	agg Arg	agg Arg 260	ccg Pro	gac Asp	atg Met	aat Asn	cca Pro 265	820
ctt Leu	att Ile	ttc Phe	aaa Lys	ctc Leu 270	gcc Ala	aaa Lys	ctc Leu	aac Asn	ttc Phe 275	aat Asn	att Ile	gtt Val	cag Gln	gca Ala 280	aca Thr	868
tat Tyr	caa Gln	gaa Glu	gaa Glu 285	ctg Leu	aaa Lys	gat Asp	atc Ile	tca Ser 290	agg Arg	tgg Trp	tgg Trp	aat Asn	agt Ser 295	tcg Ser	tgc Cys	916
ctt Leu	gct Ala	gag Glu 300	aaa Lys	ctc Leu	cca Pro	ttt Phe	gtg Val 305	aga Arg	gat Asp	agg Arg	att Ile	gtg Val 310	gaa Glu	tgc Cys	ttc Phe	964
ttt Phe 315	tgg Trp	gcc Ala	atc Ile	gcg Ala	gct Ala	ttt Phe 320	gag Glu	cct Pro	cac His	caa Gln	tat Tyr 325	agt Ser	tat Tyr	cag Gln	aga Arg	1012
aaa	atg	gcc	gcc	gtt	att	att	act	ttc	ata	aca	att	atc	gat	gat	gtt	1060

Lys 330	Met	Ala	Ala	Val	Ile 335	Ile	Thr	Phe	Ile	Thr 340	Ile	Ile	Asp	Asp	Val 345	
tat Tyr	gat Asp	gtg Val	tat Tyr	gga Gly 350	aca Thr	ata Ile	gaa Glu	gaa Glu	cta Leu 355	gaa Glu	cta Leu	tta Leu	aca Thr	gat Asp 360	atg Met	1108
att Ile	cgc Arg	aga Arg	tgg Trp 365	gat Asp	aat Asn	aaa Lys	tca Ser 370	ata Ile	agc Ser	caa Gln	ctt Leu	cca Pro	tat Tyr 375	tat Tyr	atg Met	1156
caa Gln	gtg Val	tgc Cys 380	tat Tyr	ttg Leu	gca Ala	cta Leu	tac Tyr 385	aac Asn	ttc Phe	gtt Val	tct Ser	gag Glu 390	cgg Arg	gct Ala	tac Tyr	1204
gat Asp	att Ile 395	cta Leu	aaa Lys	gat Asp	caa Gln	cat His 400	ttc Phe	aac Asn	agc Ser	atc Ile	cca Pro 405	tat Tyr	tta Leu	cag Gln	aga Arg	1252
tcg Ser 410	tgg Trp	gta Val	agt Ser	ttg Leu 415	gtt Val	gaa Glu	gga Gly	tat Tyr	ctt Leu	aag Lys 420	gag Glu	gca Ala	tac Tyr	tgg Trp	tac Tyr 425	1300
tac Tyr	aat Asn	ggc Gly	tat Tyr	aaa Lys 430	cca Pro	agc Ser	ttg Leu	gaa Glu	gaa Glu	tat Tyr	ctc Leu	aac Asn	aac Asn	gcc Ala 440	aag Lys	1348
att Ile	tca Ser	ata Ile	tcg Ser 445	gct Ala	cct Pro	aca Thr	atc Ile	ata Ile	tcc Ser	cag Gln	ctt Leu	tat Tyr	ttt Phe 455	aca Thr	tta Leu	1396
gca Ala	aac Asn	tcg Ser 460	att Ile	gat Asp	gaa Glu	aca Thr	gct Ala 465	atc Ile	gag Glu	agc Ser	ttg Leu	tac Tyr 470	caa Gln	tat Tyr	cat His	1444
aac Asn 475	ata Ile	ctt Leu	tac Tyr	cta Leu	tca Ser	gga Gly 480	acc Thr	ata Ile	tta Leu	agg Arg	ctt Leu 485	gct Ala	gac Asp	gat Asp	ctt Leu	1492
ggg Gly 490	aca Thr	tca Ser	caa Gln	cat His	gag Glu 495	ctg Leu	gag Glu	aga Arg	gga Gly	gac Asp 500	gta Val	ccg Pro	aaa Lys	gca Ala	atc Ile 505	1540
cag Gln	tgc Cys	tac Tyr	atg Met	aat Asn 510	gac Asp	aca Thr	aat Asn	gct Ala	tcg Ser 515	gag Glu	aga Arg	gag Glu	gcg Ala	gtg Val 520	gaa Glu	1588
cac His	gtg Val	aag Lys	ttt Phe 525	ctg Leu	ata Ile	agg Arg	gag Glu	gcg Ala 530	tgg Trp	aag Lys	gag Glu	atg Met	aac Asn 535	acg Thr	gtc Val	1636
aca Thr	aca Thr	gcc Ala	agc Ser	gat Asp	tgt Cys	ccg Pro	ttt Phe	acg Thr	gat Asp	gat Asp	ttg Leu	gtt Val	gcg Ala	gcc Ala	gca Ala	1684

540	545	550	
gct aat ctt gca agg gcg gct cag ttt ata tat ctc gac ggg gat ggg			1732
Ala Asn Leu Ala Arg Ala Ala Gln Phe Ile Tyr Leu Asp Gly Asp Gly			
555	560	565	
cat ggc gtg caa cac tca gaa ata cat caa cag atg gga ggc ctg cta			1780
His Gly Val Gln His Ser Glu Ile His Gln Gln Met Gly Gly Leu Leu			
570	575	580	585
ttc cag cct tat gtc tga ataaatcgaa aatccaacct actatgtatc			1828
Phe Gln Pro Tyr Val *			
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 <213> *Salvia officinalis*

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Pro Ala Ala Arg Leu Arg Ala Ser Ser Leu Gln Gln Glu Lys Pro	
35 40 45	
His Gln Ile Arg Arg Ser Gly Asp Tyr Gln Pro Ser Leu Trp Asp Phe	
50 55 60	
Asn Tyr Ile Gln Ser Leu Asn Thr Pro Tyr Lys Glu Gln Arg His Phe	
65 70 75 80	
Asn Arg Gln Ala Glu Leu Ile Met Gln Val Arg Met Leu Leu Lys Val	
85 90 95	
Lys Met Glu Ala Ile Gln Gln Leu Glu Leu Ile Asp Asp Leu Gln Tyr	
100 105 110	
Leu Gly Leu Ser Tyr Phe Phe Gln Asp Glu Ile Lys Gln Ile Leu Ser	
115 120 125	
Ser Ile His Asn Glu Pro Arg Tyr Phe His Asn Asn Asp Leu Tyr Phe	
130 135 140	
Thr Ala Leu Gly Phe Arg Ile Leu Arg Gln His Gly Phe Asn Val Ser	
145 150 155 160	
Glu Asp Val Phe Asp Cys Phe Lys Ile Glu Lys Cys Ser Asp Phe Asn	
165 170 175	
Ala Asn Leu Ala Gln Asp Thr Lys Gly Met Leu Gln Leu Tyr Glu Ala	
180 185 190	
Ser Phe Leu Leu Arg Glu Gly Glu Asp Thr Leu Glu Leu Ala Arg Arg	
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Phe Ser Thr Arg Ser Leu Arg Glu Lys Phe Asp Glu Gly Gly Asp Glu	
210 215 220	
Ile Asp Glu Asp Leu Ser Ser Trp Ile Arg His Ser Leu Asp Leu Pro	
225 230 235 240	

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Tyr	Ala	Arg	Arg	Pro	Asp	Met	Asn	Pro	Leu	Ile	Phe	Lys	Leu	Ala	Lys	
				260				265					270			
Leu	Asn	Phe	Asn	Ile	Val	Gln	Ala	Thr	Tyr	Gln	Glu	Glu	Leu	Lys	Asp	
		275					280					285				
Ile	Ser	Arg	Trp	Trp	Asn	Ser	Ser	Cys	Leu	Ala	Glu	Lys	Leu	Pro	Phe	
	290				295						300					
Val	Arg	Asp	Arg	Ile	Val	Glu	Cys	Phe	Phe	Trp	Ala	Ile	Ala	Ala	Phe	
305					310					315					320	
Glu	Pro	His	Gln	Tyr	Ser	Tyr	Gln	Arg	Lys	Met	Ala	Ala	Val	Ile	Ile	
				325					330					335		
Thr	Phe	Ile	Thr	Ile	Ile	Asp	Asp	Val	Tyr	Asp	Val	Tyr	Gly	Thr	Ile	
			340					345					350			
Glu	Glu	Leu	Glu	Leu	Leu	Thr	Asp	Met	Ile	Arg	Arg	Trp	Asp	Asn	Lys	
		355					360					365				
Ser	Ile	Ser	Gln	Leu	Pro	Tyr	Tyr	Met	Gln	Val	Cys	Tyr	Leu	Ala	Leu	
	370					375					380					
Tyr	Asn	Phe	Val	Ser	Glu	Arg	Ala	Tyr	Asp	Ile	Leu	Lys	Asp	Gln	His	
385					390					395					400	
Phe	Asn	Ser	Ile	Pro	Tyr	Leu	Gln	Arg	Ser	Trp	Val	Ser	Leu	Val	Glu	
				405					410					415		
Gly	Tyr	Leu	Lys	Glu	Ala	Tyr	Trp	Tyr	Tyr	Asn	Gly	Tyr	Lys	Pro	Ser	
			420					425					430			
Leu	Glu	Glu	Tyr	Leu	Asn	Asn	Ala	Lys	Ile	Ser	Ile	Ser	Ala	Pro	Thr	
		435					440					445				
Ile	Ile	Ser	Gln	Leu	Tyr	Phe	Thr	Leu	Ala	Asn	Ser	Ile	Asp	Glu	Thr	
	450					455					460					
Ala	Ile	Glu	Ser	Leu	Tyr	Gln	Tyr	His	Asn	Ile	Leu	Tyr	Leu	Ser	Gly	
465					470					475					480	
Thr	Ile	Leu	Arg	Leu	Ala	Asp	Asp	Leu	Gly	Thr	Ser	Gln	His	Glu	Leu	
				485					490					495		
Glu	Arg	Gly	Asp	Val	Pro	Lys	Ala	Ile	Gln	Cys	Tyr	Met	Asn	Asp	Thr	
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Asn	Ala	Ser	Glu	Arg	Glu	Ala	Val	Glu	His	Val	Lys	Phe	Leu	Ile	Arg	
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Glu	Ala	Trp	Lys	Glu	Met	Asn	Thr	Val	Thr	Thr	Ala	Ser	Asp	Cys	Pro	
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Gln	Phe	Ile	Tyr	Leu	Asp	Gly	Asp	Gly	His	Gly	Val	Gln	His	Ser	Glu	
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Ile	His	Gln	Gln	Met	Gly	Gly	Leu	Leu	Phe	Gln	Pro	Tyr	Val			
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<223> abietadiene synthase

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gct	cat	cat	cta	act	gct	aac	gca	caa	tcc	att	ccg	cat	ttc	tcc	acg		95
Ala	His	His	Leu	Thr	Ala	Asn	Ala	Gln	Ser	Ile	Pro	His	Phe	Ser	Thr		
				20					25					30			
acg	ctg	aat	gct	gga	agc	agt	gct	agc	aaa	cgg	aga	agc	ttg	tac	cta		143
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His	Val	Tyr	Ser	Val	Met	Glu	Asn	Ala	Leu	Glu	Glu	Leu	Asn	Arg	Glu
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Phe	Val	Asn	Asn	Lys	Ile	Pro	Asp	Ile	Tyr	Lys	Arg	Leu	Val	Phe	Glu
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Leu	Ser	His	Asp	Met	Glu	Ile	Lys	Glu	His	Val	Lys	Asn	Cys	Leu	Phe
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	Met Ala Leu Leu Ser Ile Val Ser Leu Gln Val Pro Lys						
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Ser Cys Gly Leu Lys Ser Leu Ile Ser Ser Ser Asn Val Gln Lys Ala							
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Leu Cys Ile Ser Thr Ala Val Pro Thr Leu Arg Met Arg Arg Arg Gln							
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Gly	Ser	Ser	Tyr	Ser	Glu	Arg	Ala	Glu	Thr	Val	Val	Glu	Glu	Val	Lys	
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gag	atg	ttc	aat	tca	ata	cca	aat	aat	aga	gaa	tta	ttt	ggt	tcc	caa	447
Glu	Met	Phe	Asn	Ser	Ile	Pro	Asn	Asn	Arg	Glu	Leu	Phe	Gly	Ser	Gln	
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Ile	Thr	Arg	Ser	Val	Leu	Asn	Leu	Tyr	Arg	Ala	Ser	Leu	Val	Ala	Phe	
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Pro	Gly	Glu	Lys	Val	Met	Glu	Glu	Ala	Glu	Ile	Phe	Ser	Ala	Ser	Tyr	
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gaa Glu	gca Ala	aga Arg	aat Asn 290	tat Tyr 290	atc Ile	gag Glu	gtc Val	tac Tyr	gag Glu 295	cag Gln	agc Ser	ggc Gly	tat Tyr	gaa Glu 300	agc Ser	975
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aaa Lys	ttg Leu	gag Glu 320	ttc Phe	aat Asn	atc Ile	ttt Phe	cac His 325	tct Ser	ttg Leu	caa Gln	cta Leu	aga Arg 330	gag Glu	tta Leu	caa Gln	1071
tct Ser 335	atc Ile	tcc Ser	aga Arg	tgg Trp	tgg Trp	aaa Lys 340	gaa Glu	tca Ser	ggt Gly	tcg Ser	tct Ser 345	caa Gln	ctg Leu	act Thr	ttt Phe	1119
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atg Met	ttg Leu	cca Pro	aaa Lys 370	cat His	tca Ser	gct Ala	ttc Phe	aga Arg	atg Met 375	gag Glu	ttt Phe	gtc Val	aaa Lys	gtg Val 380	tgt Cys	1215
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cga Arg	gat Asp	atg Met	ctc Leu	aac Asn 450	tat Tyr	att Ile	caa Gln	aat Asn 455	gct Ala 455	tgg Trp	gaa Glu	gcc Ala	cta Leu	ttt Phe 460	gat Asp	1455
acc Thr	ttt Phe	atg Met	caa Gln 465	gaa Glu	gca Ala	aag Lys	tgg Trp	atc Ile 470	tcc Ser	agc Ser	agt Ser	tat Tyr	ctc Leu 475	cca Pro	acg Thr	1503

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Phe Glu Glu Tyr Leu Lys Asn Ala Lys Val Ser Ser Gly Ser Arg Ile	
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Ala Thr Leu Gln Pro Ile Leu Thr Leu Asp Val Pro Leu Pro Asp Tyr	
495 500 505	
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Ile Leu Gln Glu Ile Asp Tyr Pro Ser Arg Phe Asn Glu Leu Ala Ser	
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Ala Arg Gly Glu Glu Ala Ser Ala Ile Ser Cys Tyr Met Lys Asp His	
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Pro Gly Ser Ile Glu Glu Asp Ala Leu Asn His Ile Asn Ala Met Ile	
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Ser Asp Ala Ile Arg Glu Leu Asn Trp Glu Leu Leu Arg Pro Asp Ser	
575 580 585	
aaa agt ccc atc tct tcc aag aaa cat gct ttt gac atc acc aga gct	1887
Lys Ser Pro Ile Ser Ser Lys Lys His Ala Phe Asp Ile Thr Arg Ala	
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Phe His His Val Tyr Lys Tyr Arg Asp Gly Tyr Thr Val Ser Asn Asn	
610 615 620	
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